TAGA NextGen

Toronto Metropolitan University

Tampere University of Applied Sciences

Expanded Color Gamut Printing 2.0: Integrating Process Control and Sustainability Assessment

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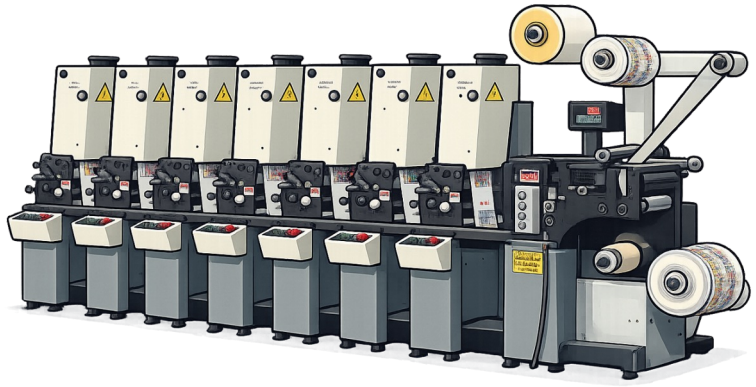
CPIS The Centre for Packaging Innovation and Sustainability

TAGA NextGen

2026

Agenda



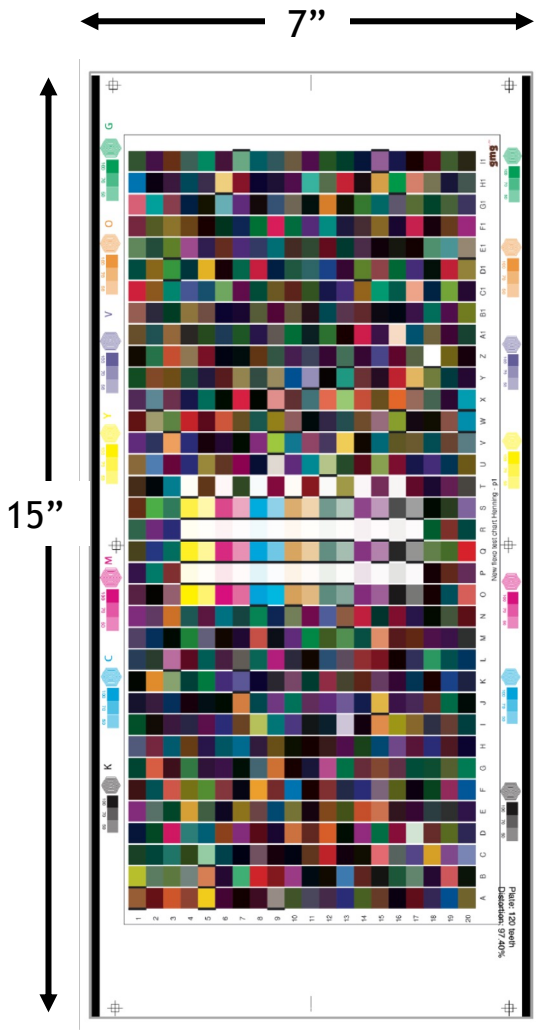
- Objective & Scope
- Background
  - Previous work at GCM
- Methodology
  - ECG approach and the Alwan process
  - PMS colors as comparison to ECG
- Experimental Setup
  - Equipment & materials
- Results
  - Predicted vs. measured values
  - Comparison of ECG vs PMS
- Key Findings & Conclusions
  - Recommendations / next steps

Objective & Scope

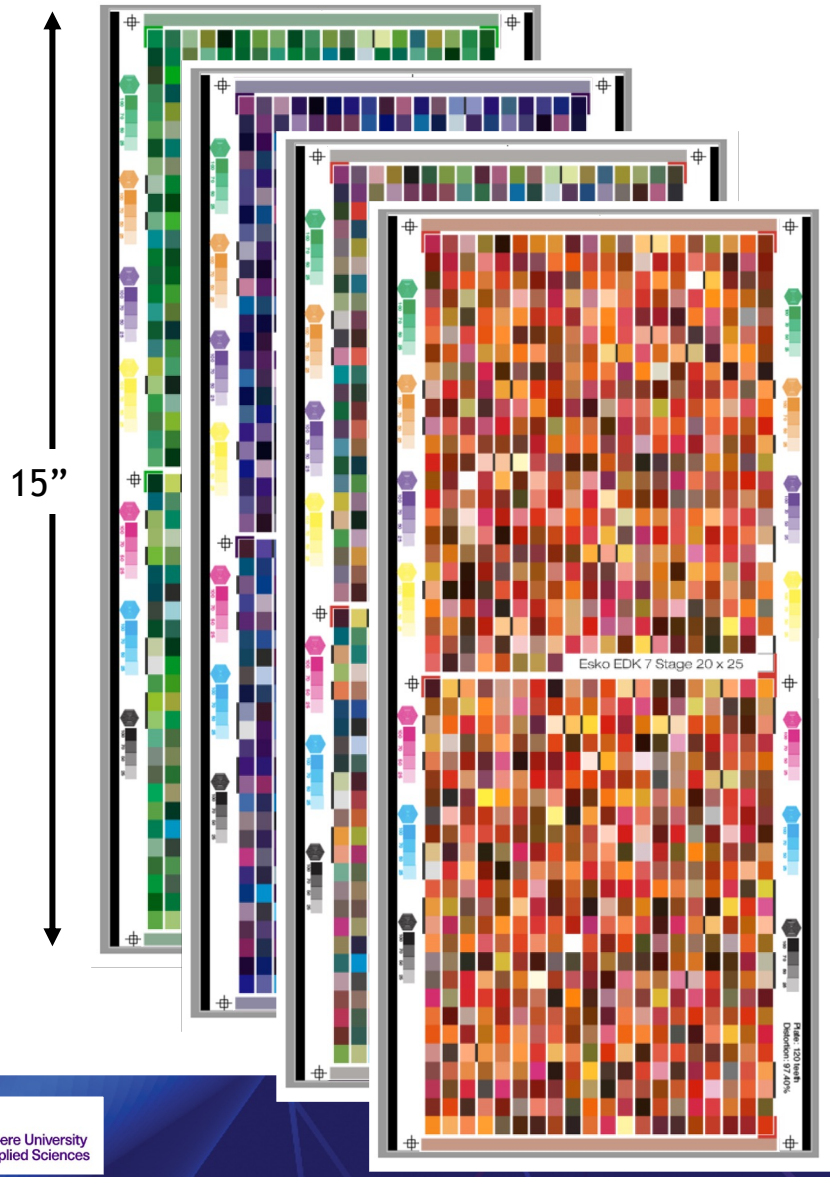
- Continuation of a project done during the pandemic
  - GMG OpenColor, Esko Equinox and an IDEAlliance small test chart were used
- Objective of this project
  - Use Alwan ColorHub and Toolbox for ECG conversions of the same test colors that were used in the previous project
  - Use the Alwan proprietary test chart and the IDEAlliance small ECG test chart
  - Compare the results

Background

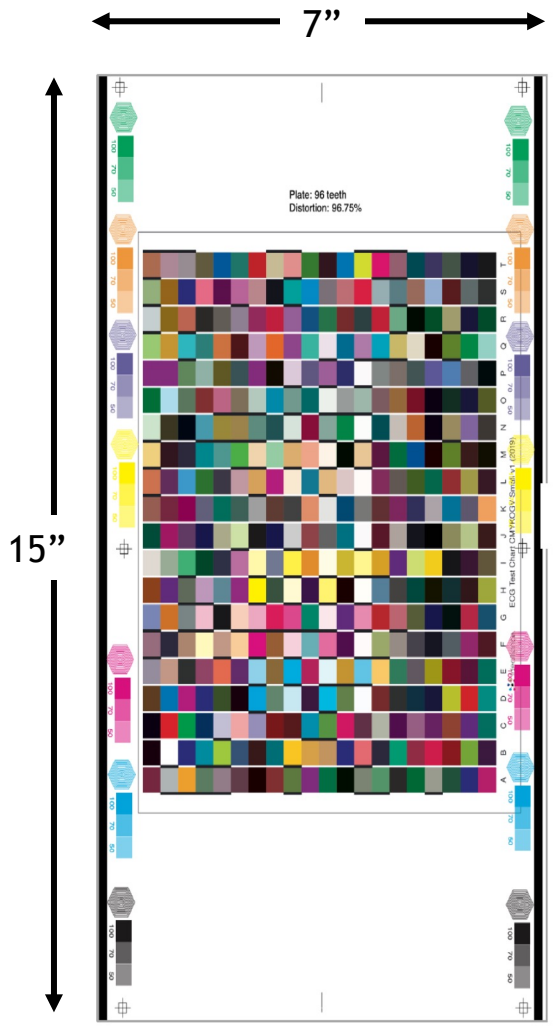
GMG Color
700 patches



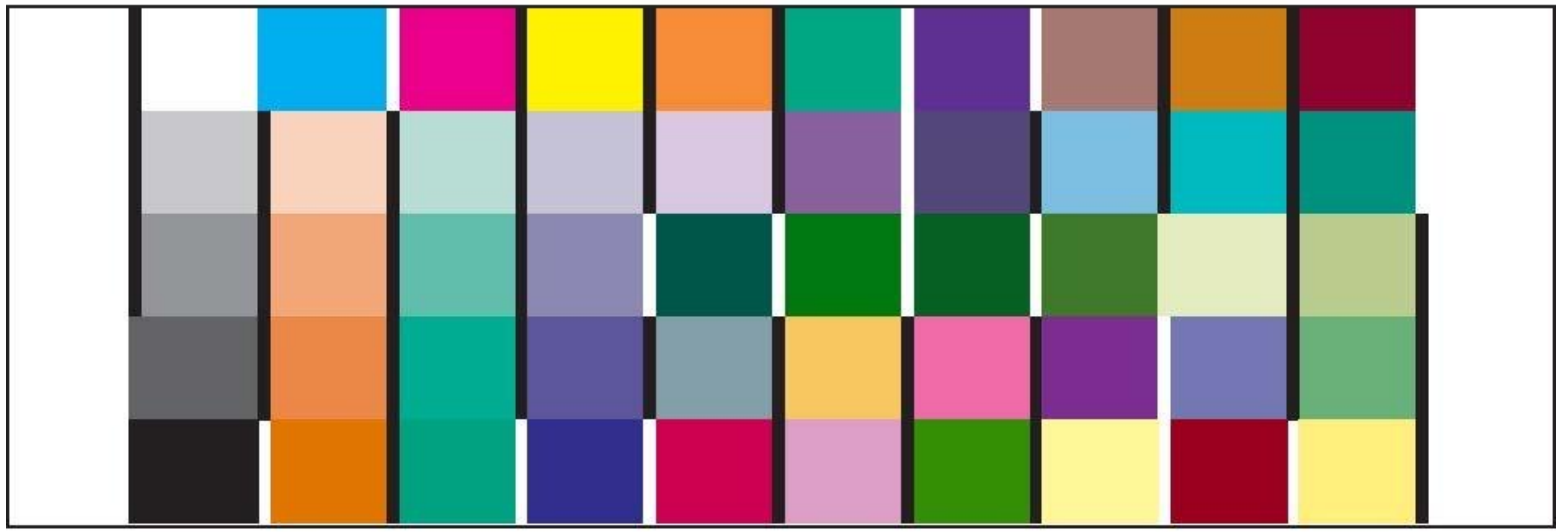
Esko Equionx EDK
3872 patches (968 x 4 = 3872)



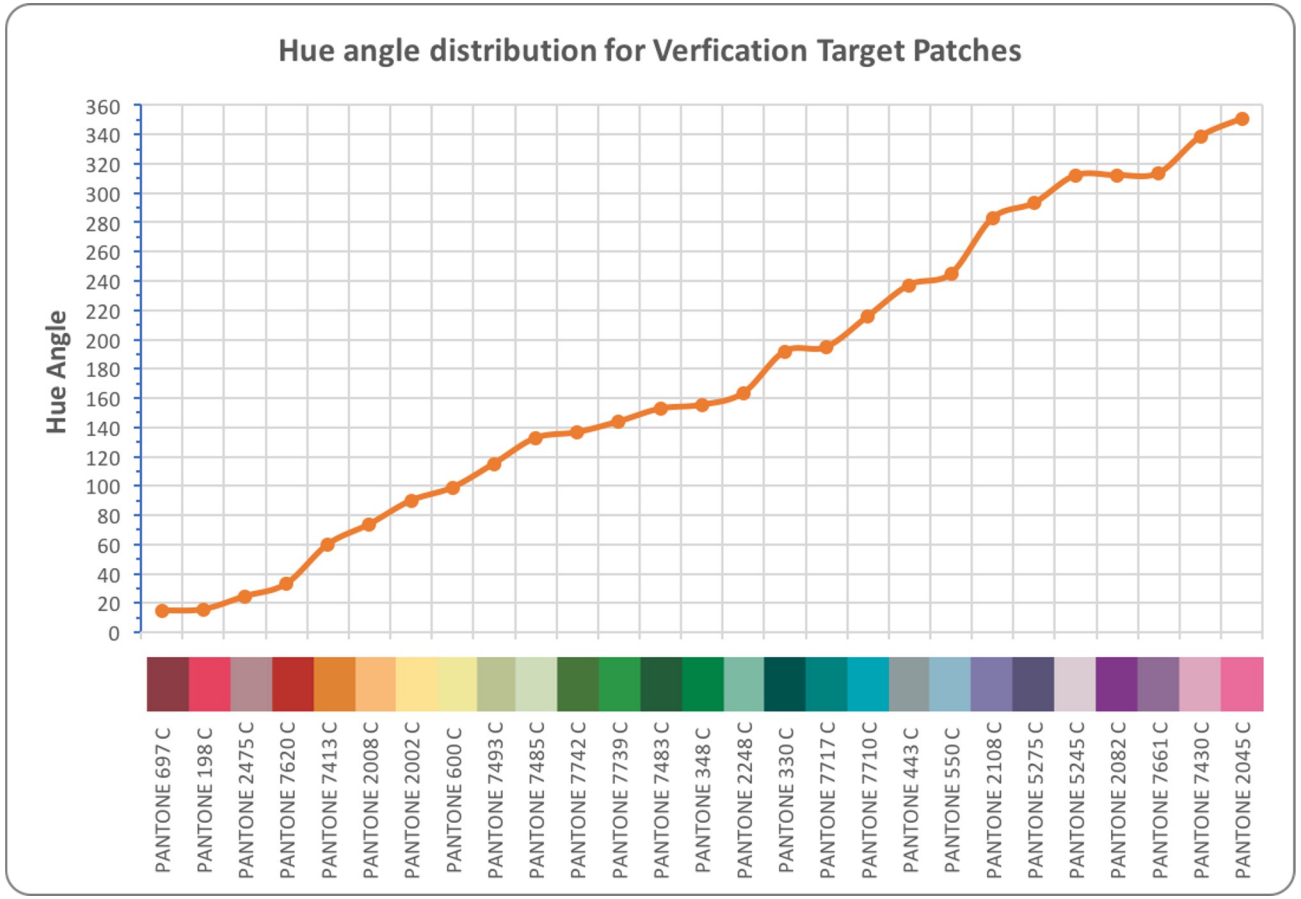
Idealliance 1-page Small v1 (2019)
400 patches



Pantone test color chart



Pantone test color chart



Methodology

- Set up a test form with Alwan 906 test patches and second test form with the IDEAlliance ECG small test chart
- Process both test charts the same way
- Measure the test targets
- Create ICC color profiles
- Convert the Pantone solid coated library V5 (M1) to ECG builds
- Compare conversion results
- Build a test chart with the same ECG test charts plus the selected Pantone colors
- Measure the L*a*b*-values of the converted Pantone colors and compare them to the L*a*b* values from Pantone

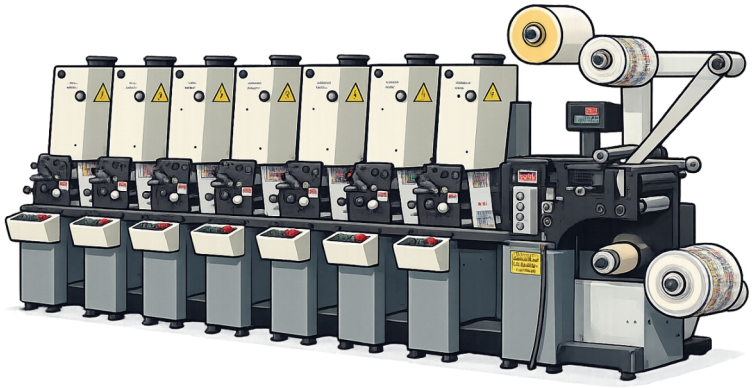
Methodology

- Select three Pantone colors which gave a good correlation between the theoretical DE00 and the measured DE00.
- Mix these as spot colors and create a test job that show labels with these colors.
- Convert this job to ECG and print with CMYKOGV.

Experimental setup

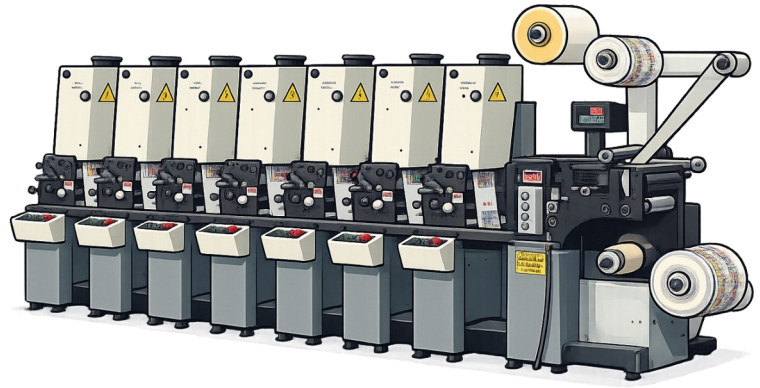
Equipment & Materials

Experimental Setup (ECG)



- Comco Cadet 7-color narrow web label press
- Substrate: Label Supply Extragloss LTR ‘Low Tack Removable’ 40#
- Inks: Siegwerk water-based flexo inks
- Anilox rollers:
  - Yellow: 1.78 BCM, 1000 LPI
  - Magenta: 1.79 BCM, 1000 LPI
  - Cyan: 1.79 BCM, 1000 LPI
  - Orange: 2.93 BCM, 550 LPI
  - Green: 2.97 BCM, 550 LPI
  - Violet: 2.18 BCM, 800 LPI
  - Black: 1.78 BCM, 1000 LPI

Experimental Setup (spot)



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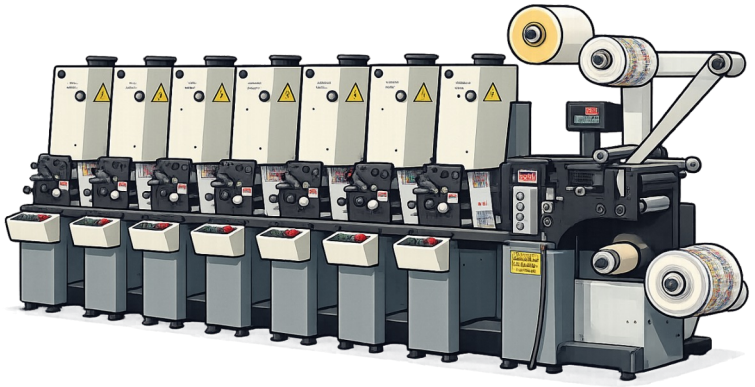
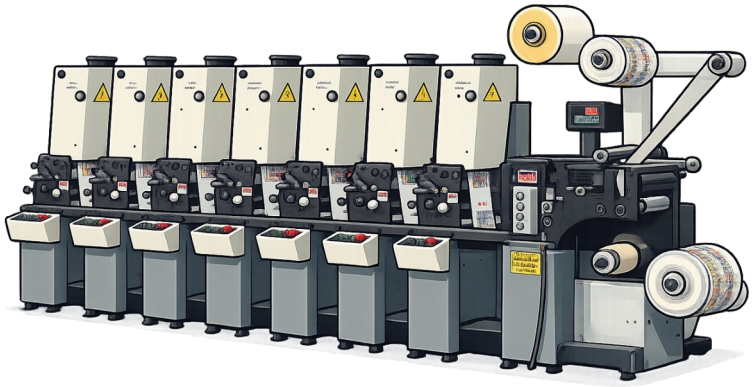
  - Magenta: 1.79 BCM, 1000 LPI
  - Cyan: 1.79 BCM, 1000 LPI
  - Black: 1.78 BCM, 1000 LPI
  - P7620 Orange: 2.18 BCM/ 800 LPI
  - P7717 Green: 2.93 BCM/ 550 LPI
  - P2091 Violet: 2.97 BCM / 550 LPI

Experimental Setup



- Plates: Toyobo Cosmolight water washable plate 0.067”
  - Plate thickness: 0.0666”
  - Floor height: 0.0436”
  - Relief: 0.0226”
- Micrometer: Mitutoyo absolute digital micrometer
- Esko CDI Spark 2530
- Anderson & Vreeland Orbital X plate processor with CL-50 Whirl-A-Way AV Polymer Removal System

Experimental Setup

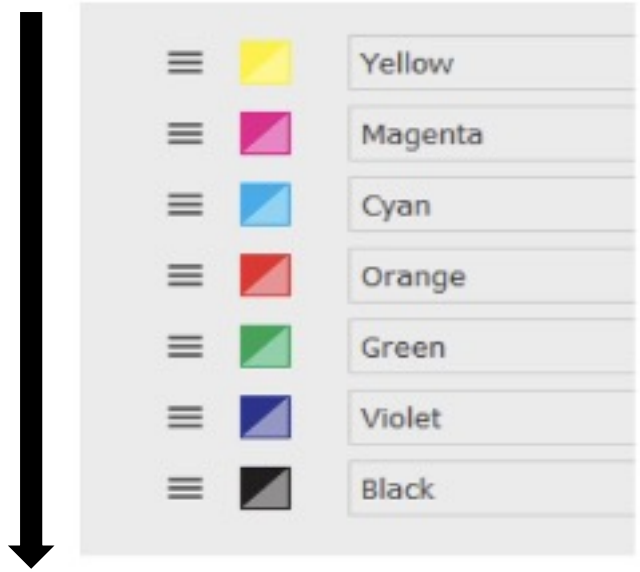


- Measurement instrument:
  - X-Rite eXact
- Software used:
  - Alwan ColorHub
  - Alwan ToolBox
  - X-Rite DataCatcher
  - Adobe Illustrator
  - MS-Excel
  - ColorThink 3.09 (Mac)

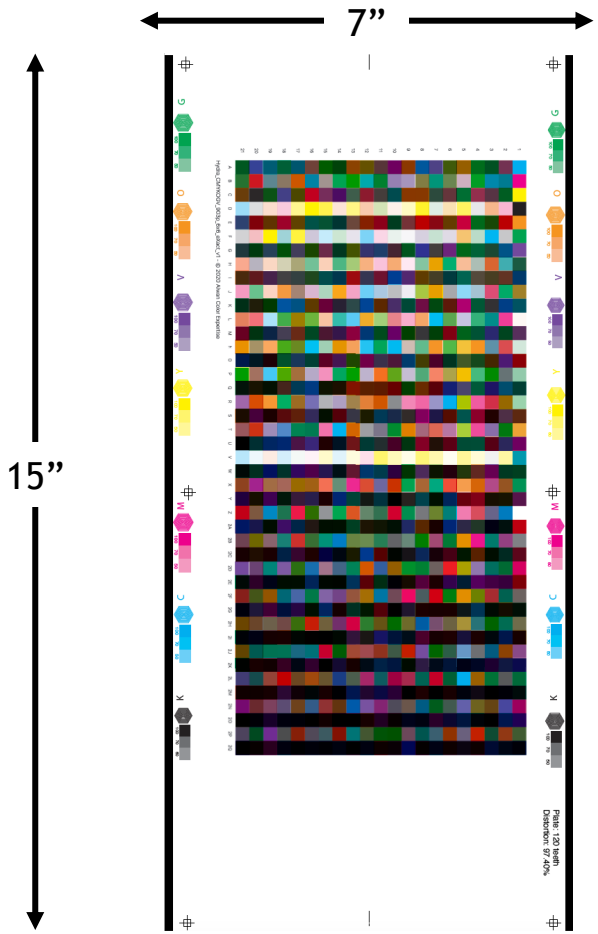
Esko “Flexo” – 7.5º set

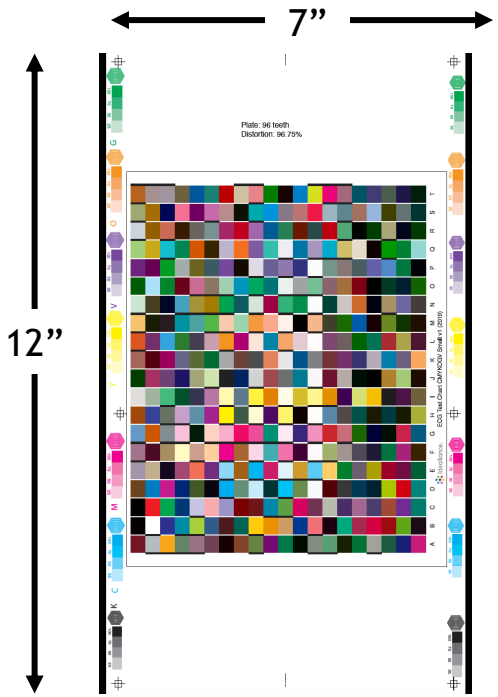
Ink Name	Ruling	Angle
Cyan	150 lpi	7.5°
Magenta	150 lpi	67.5°
Yellow	150 lpi	172.5° (=82.5°)
Black	150 lpi	127.5° (=37.5°)
Green	150 lpi	*67.5°*
Orange	150 lpi	*7.5°*
Violet	150 lpi	*172.5° (=82.5°)*

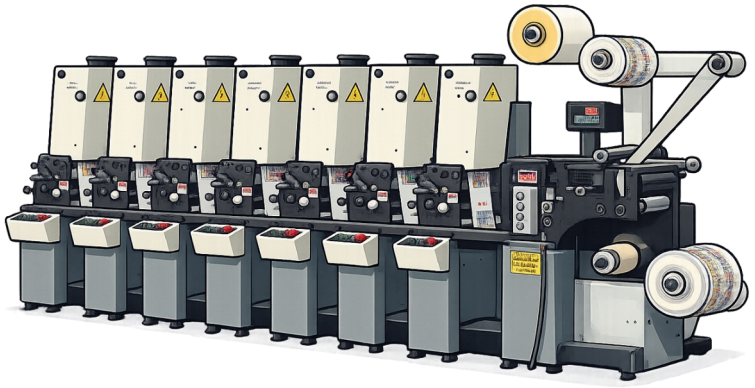
Ink Sequence



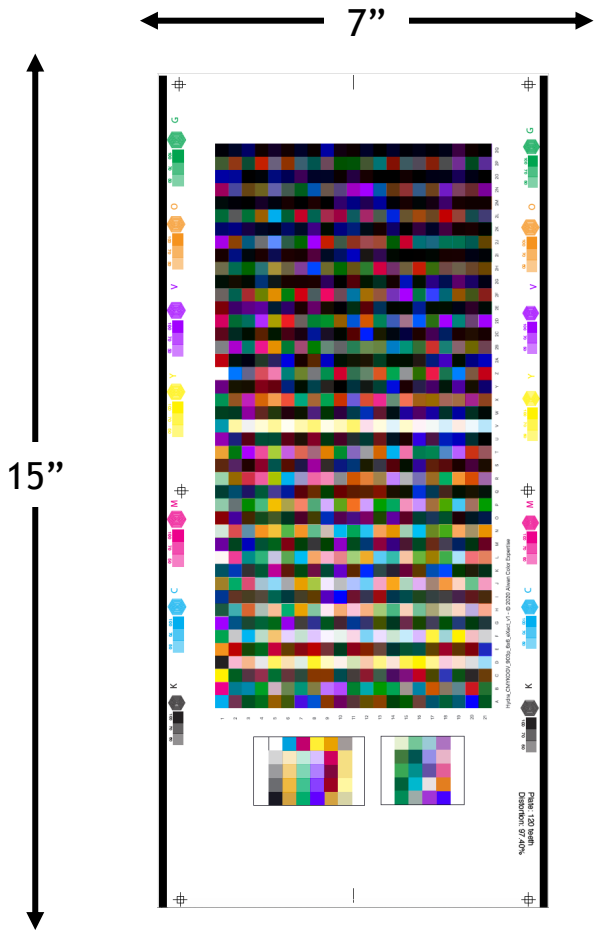
Experimental Setup (First press run)

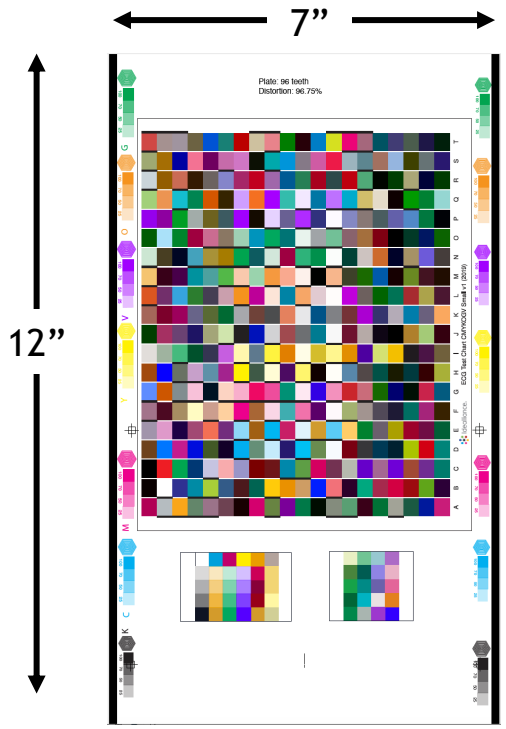


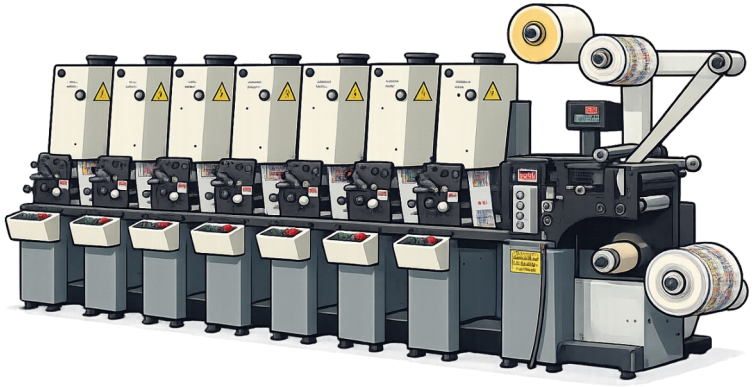


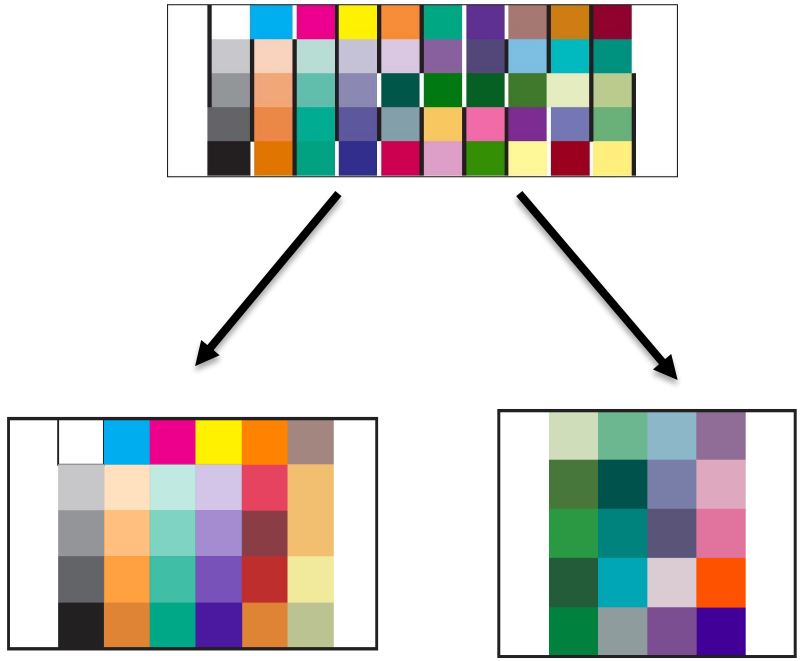


Experimental Setup (Second press run)

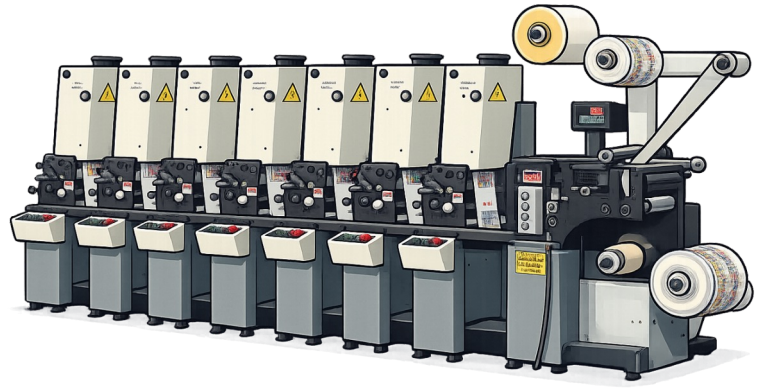


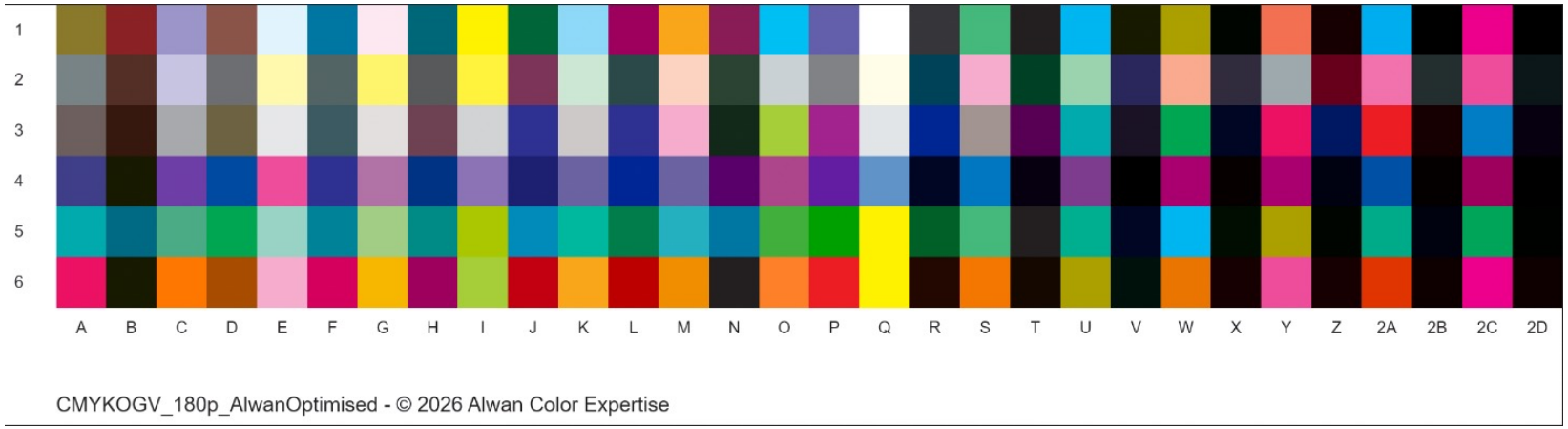






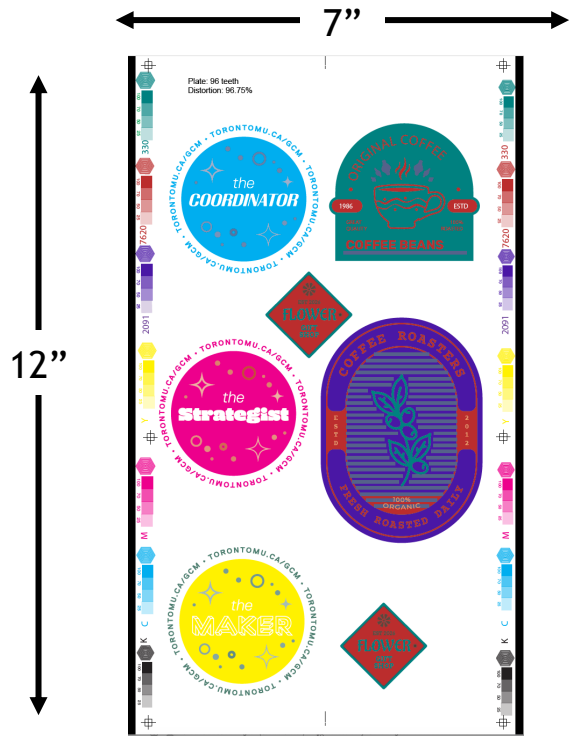
Experimental Setup



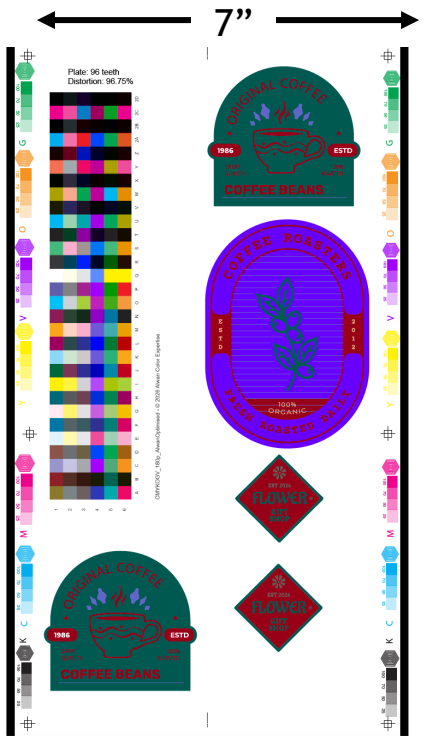


New test chart: 180 patches

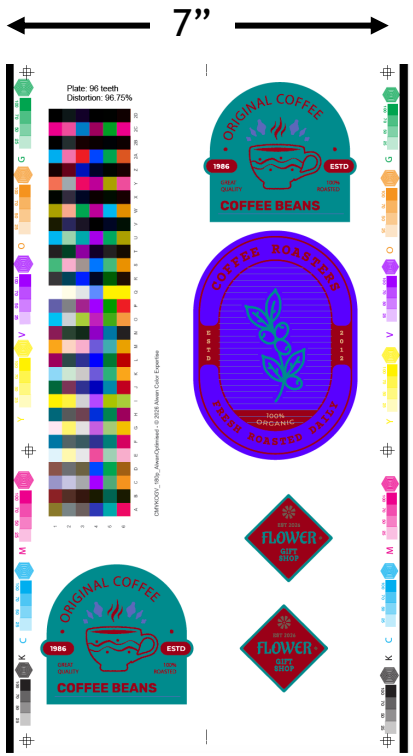
Experimental Setup (Press run three - five)



Press run with CMYK plus spot



Press run Alwan test chart ICC profile



Press run IDEAlliance test chart ICC profile

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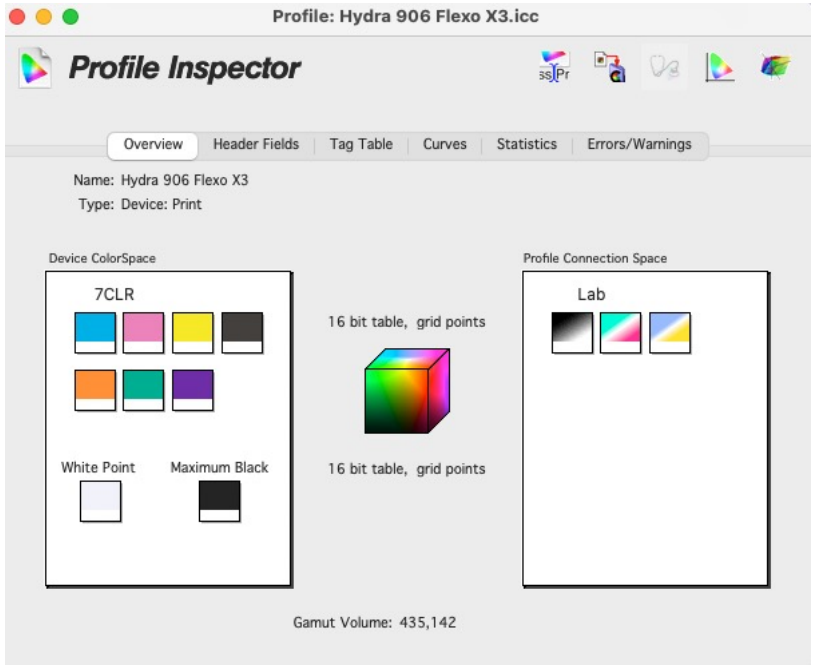
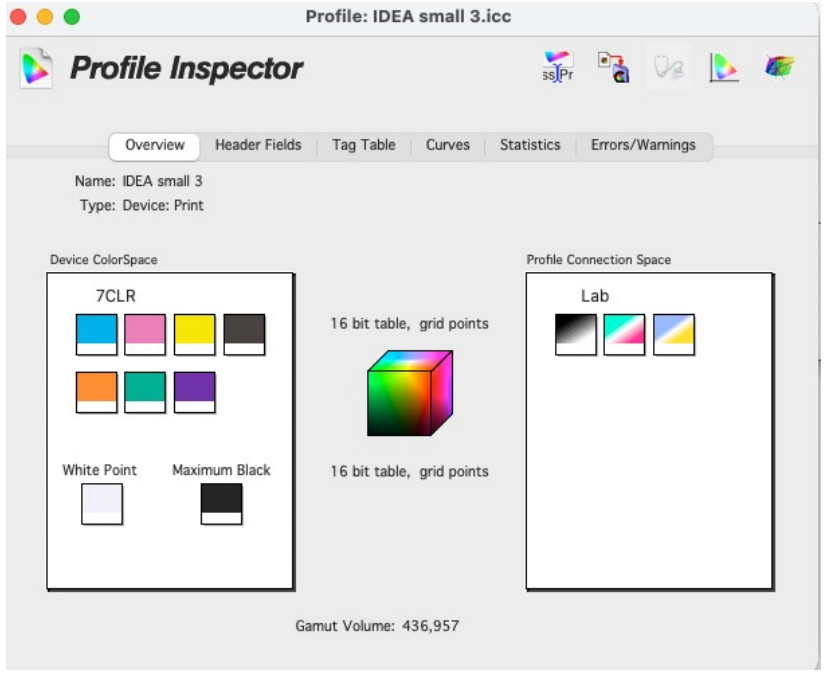
Results

Color gamut

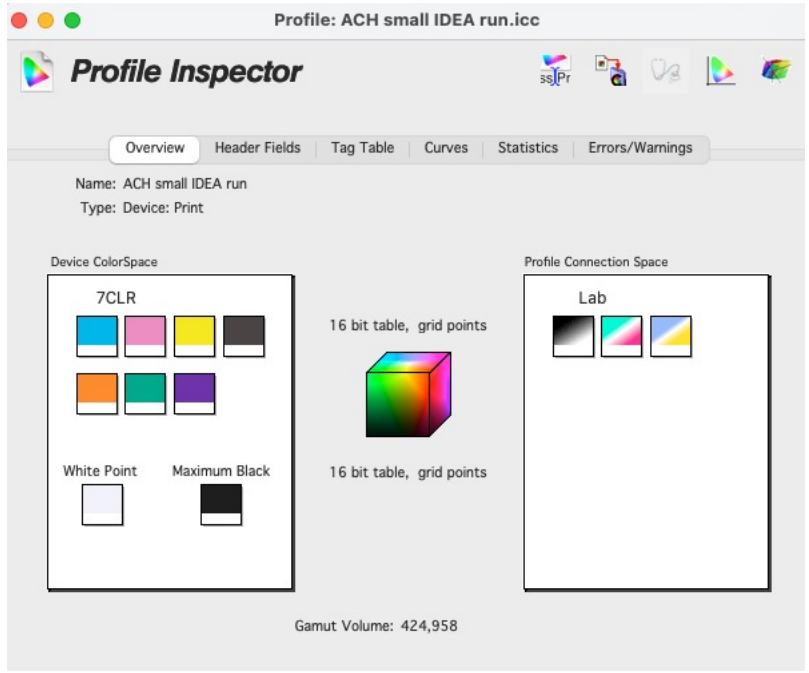
Results



Gamut volume: 435,142

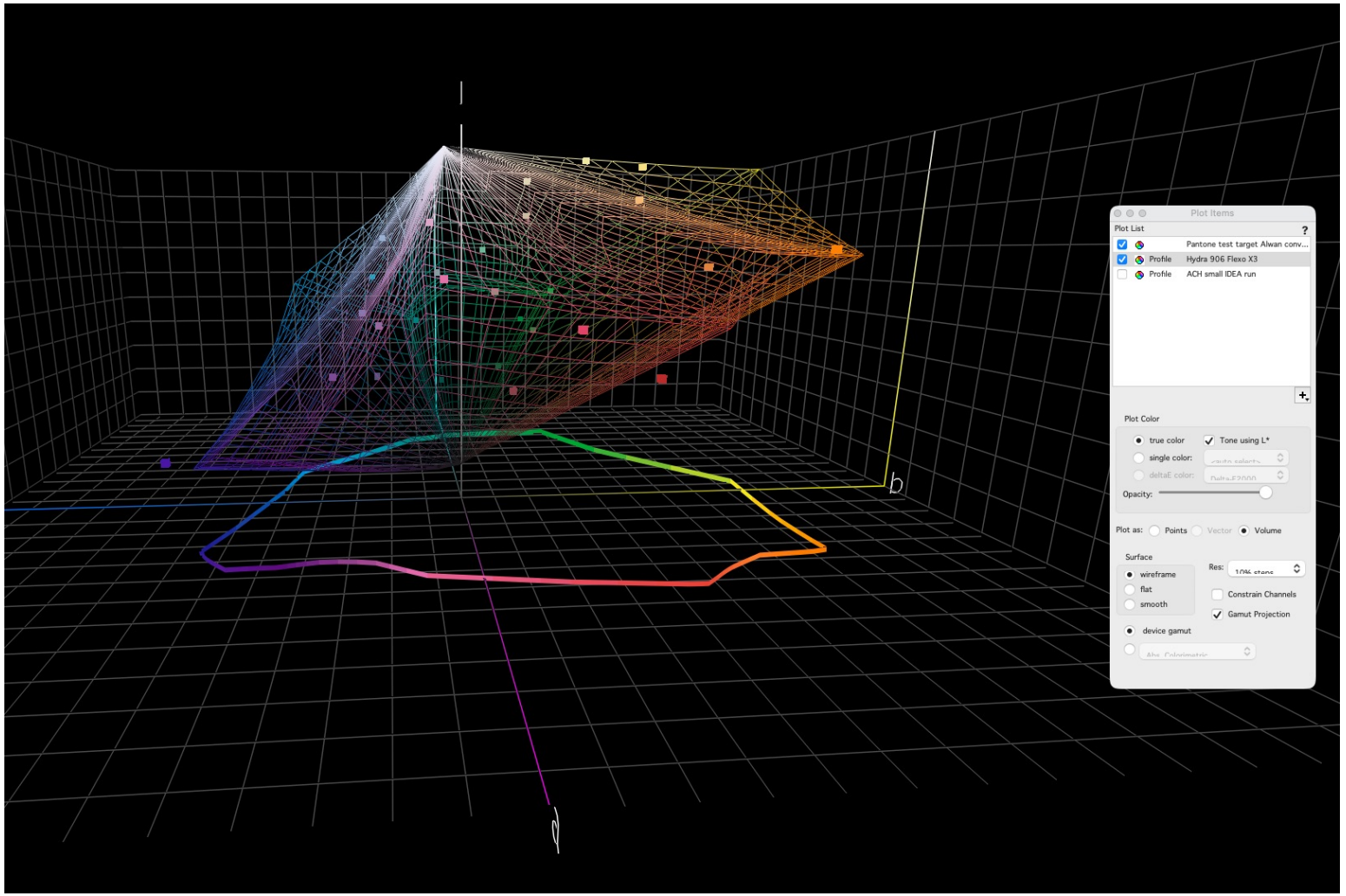


Gamut volume: 436,957

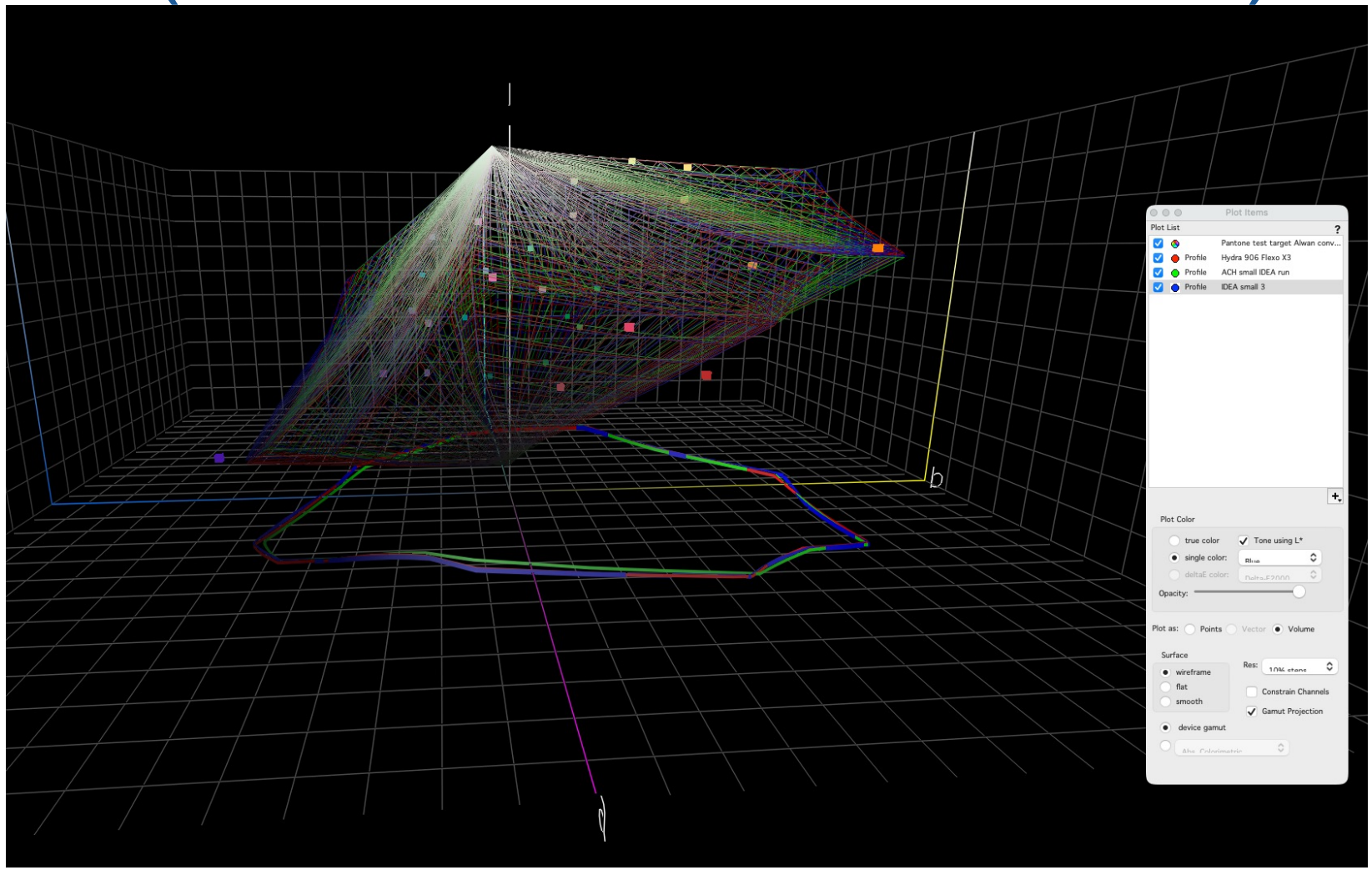


Gamut volume: 424,958

Results (Selected Pantone colors)



Results (Selected Pantone colors)



Results

- OGV color difference to different recommendations

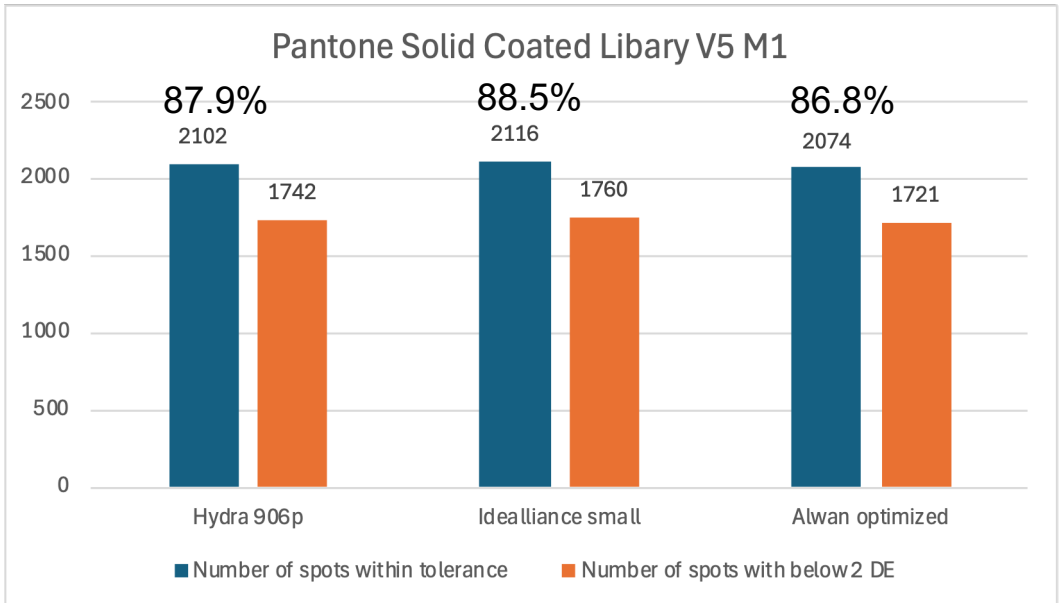
	DE2000			
	ISO/TC21328	FOGRA55	IDEAlliance 2021	Pantone XGC
Orange	3.39	4.88	3.89	6.36
Green	6.64	1.6	6.64	4.08
Violet	2.62	4.01	2.65	2.12

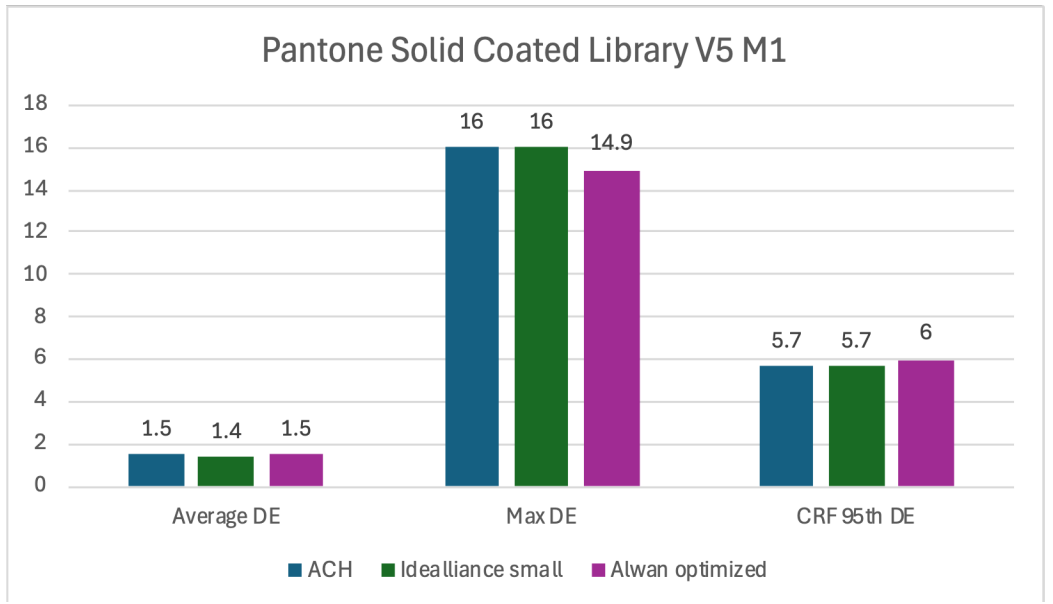
Results

Color conversions

Results

Theoretical color conversions

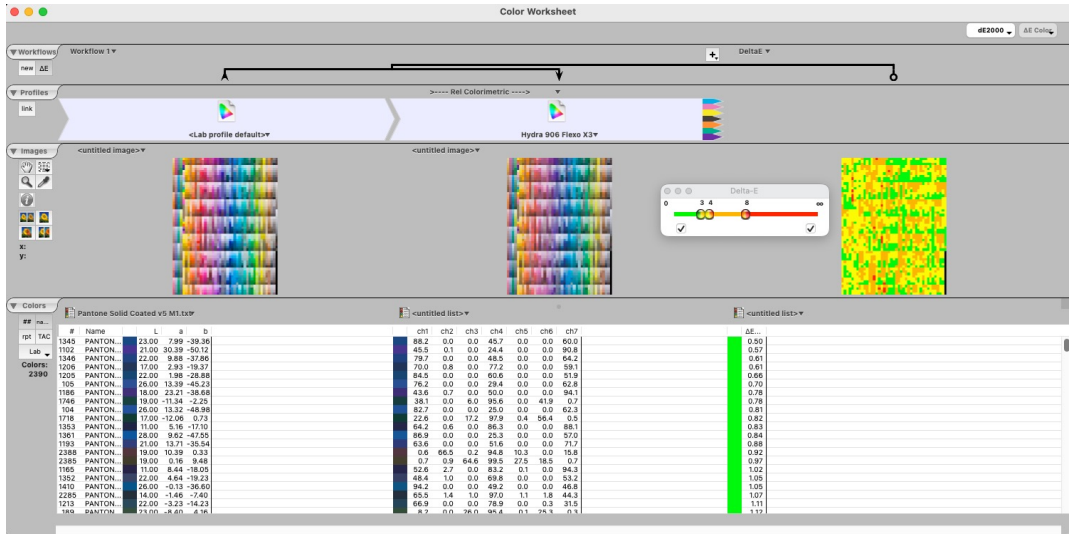


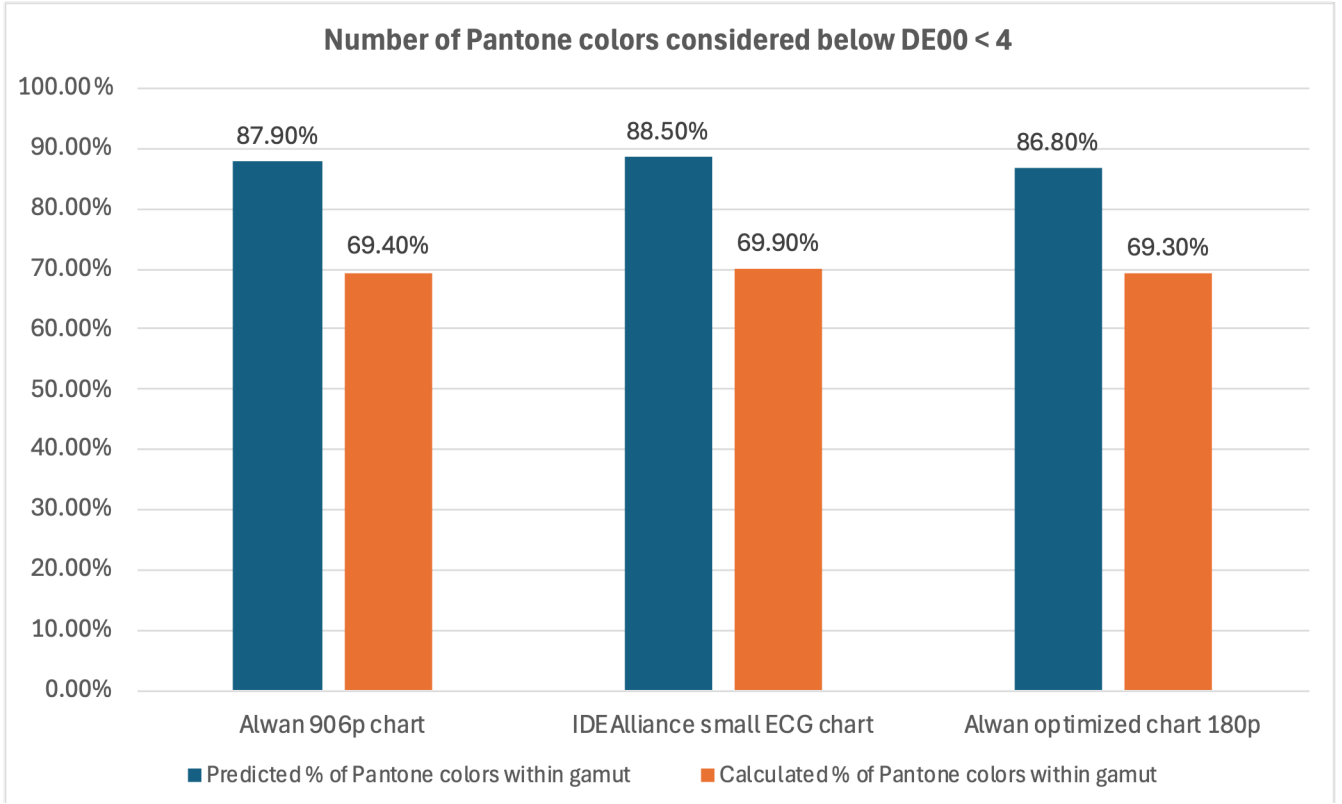


Pantone V5 library = 2390 colors

Max DE00 = 4

Results – number of colors

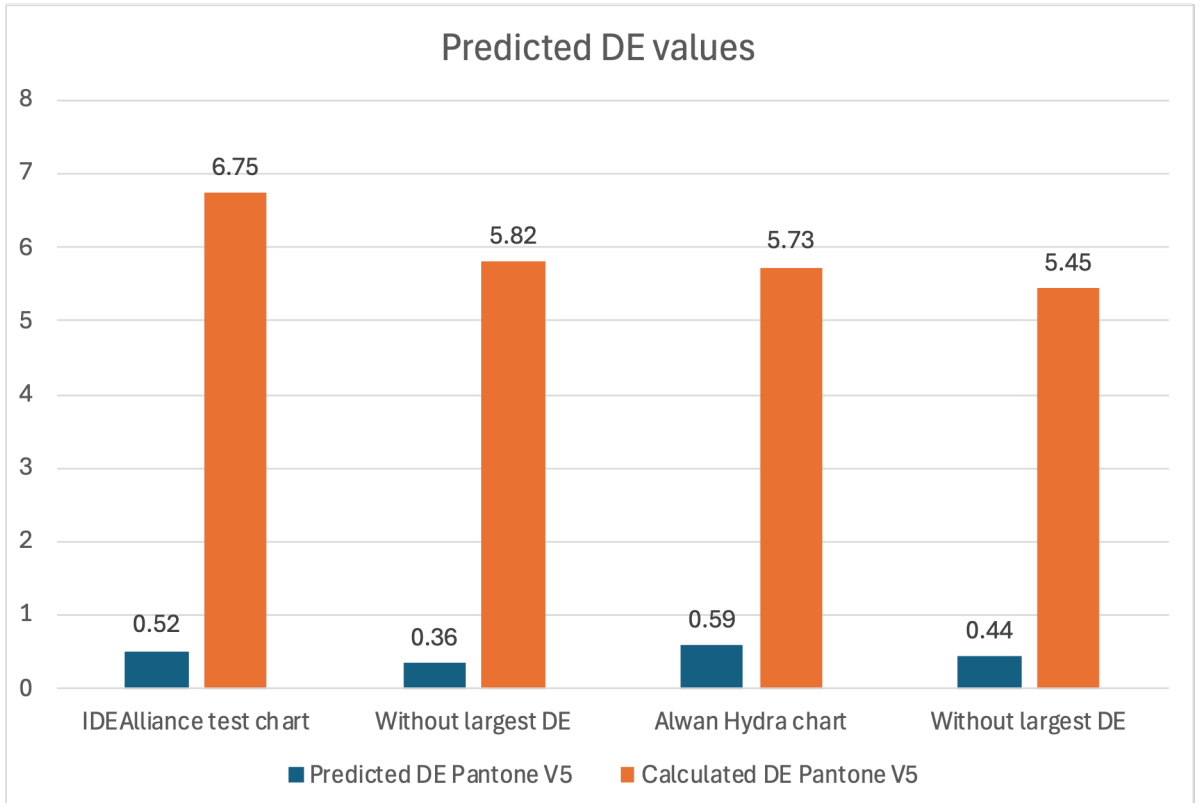




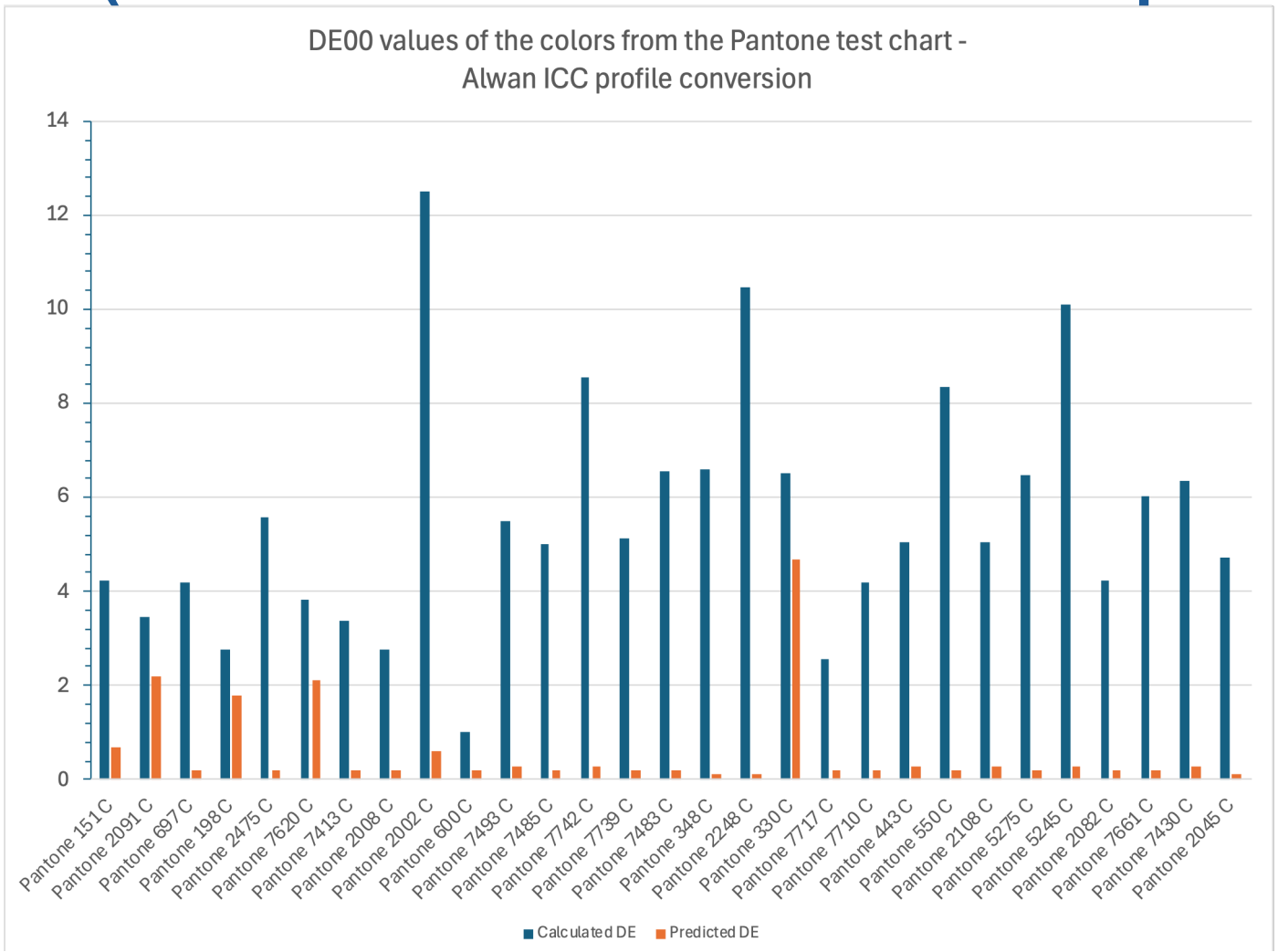
Pantone Coated V5 library – 2390 colors

Results

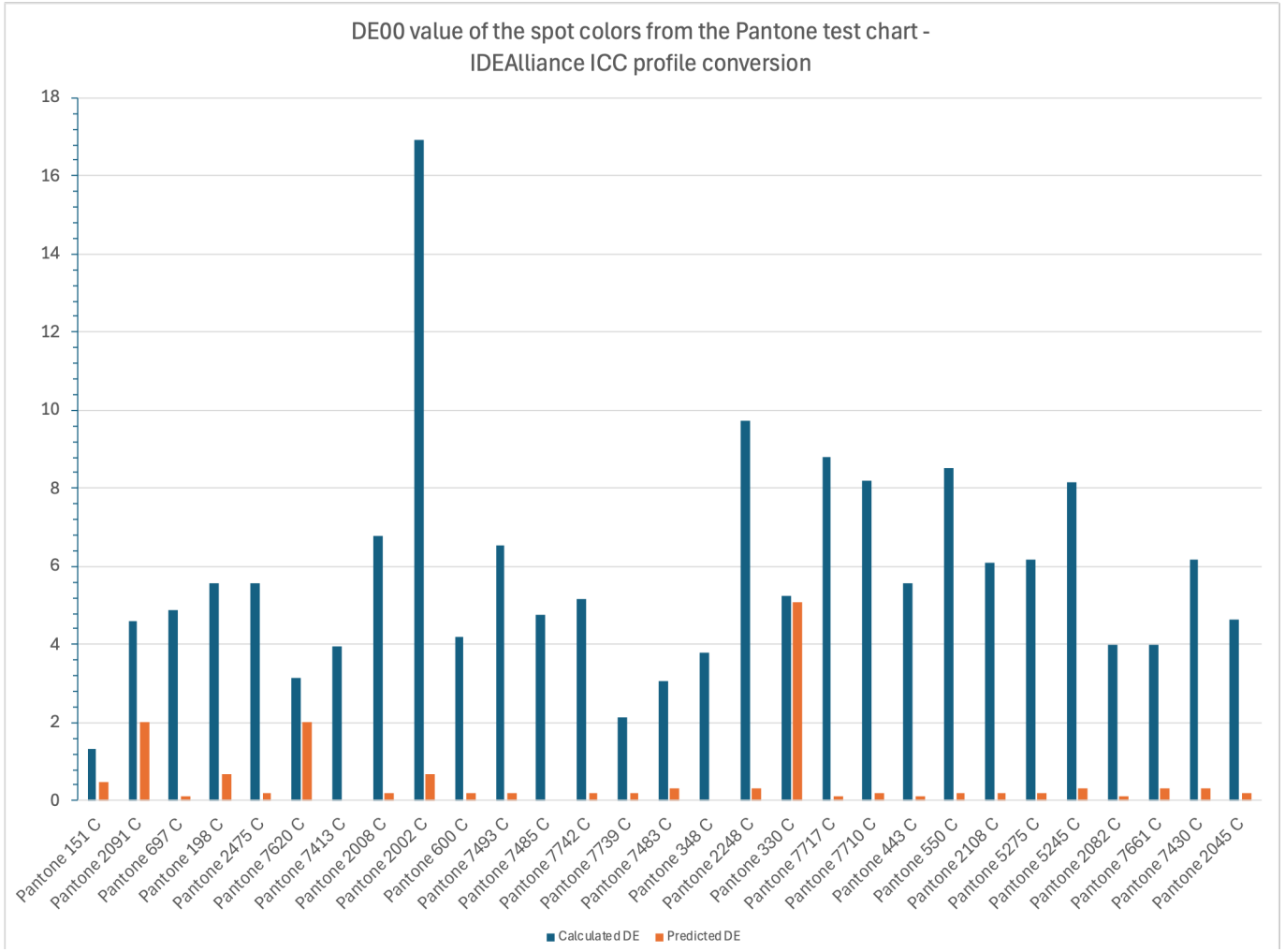
Theoretical average DE values vs measured and calculated DE value of the selected Pantone colors test chart



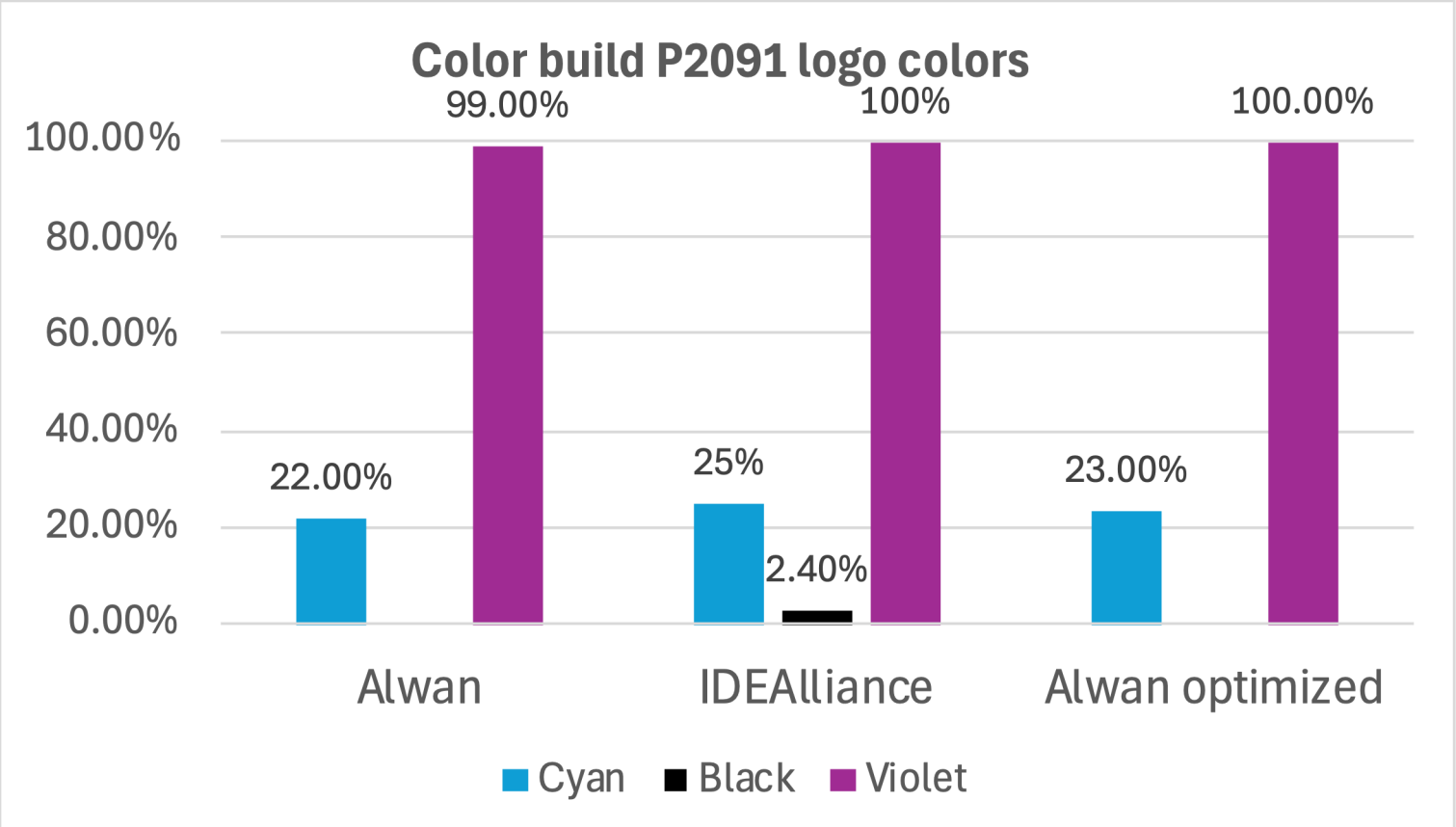
Results (Alwan test chart ICC profile)



Results (IDEAlliance test chart ICC profile)



Results (Color build comparison)



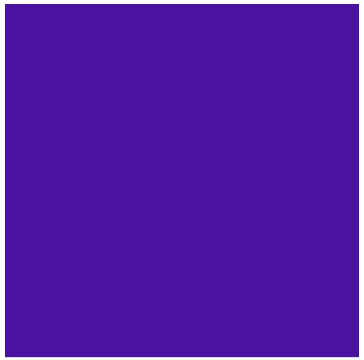
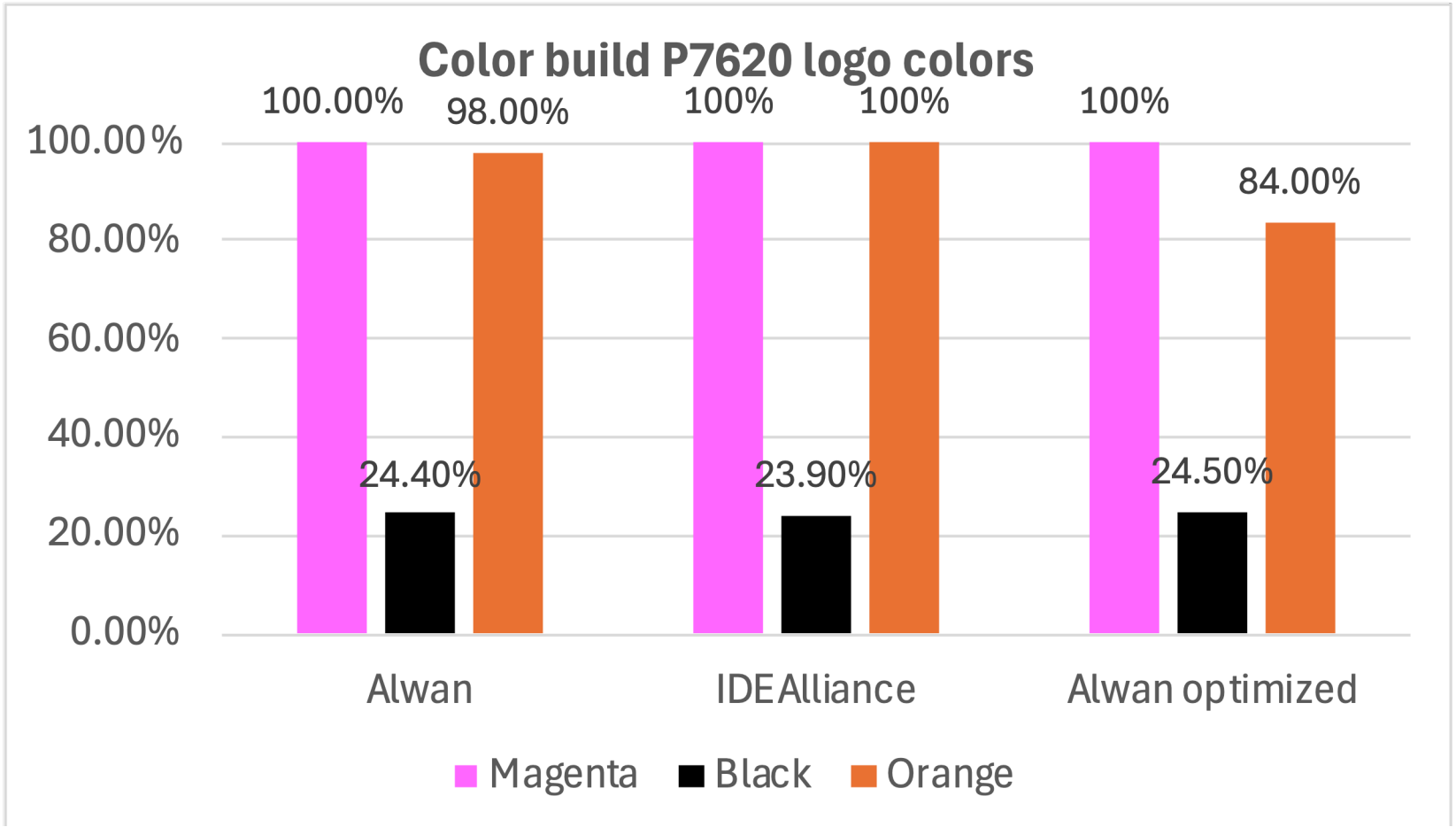


Image source: www.pantone.com

Results (Color build comparison)



PANTONE®
7620 C

Image source: www.pantone.com

Results (Color build comparison)

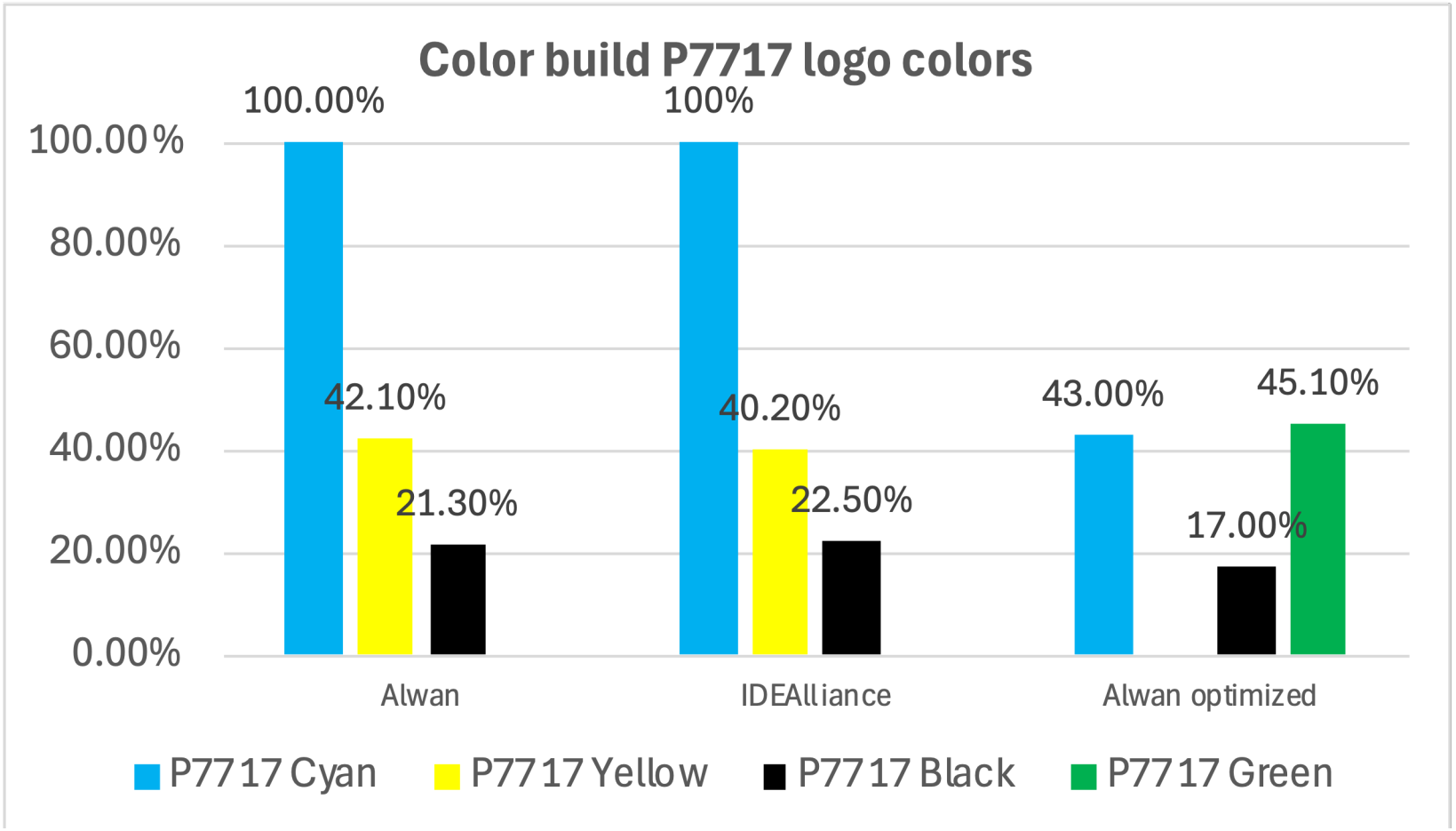
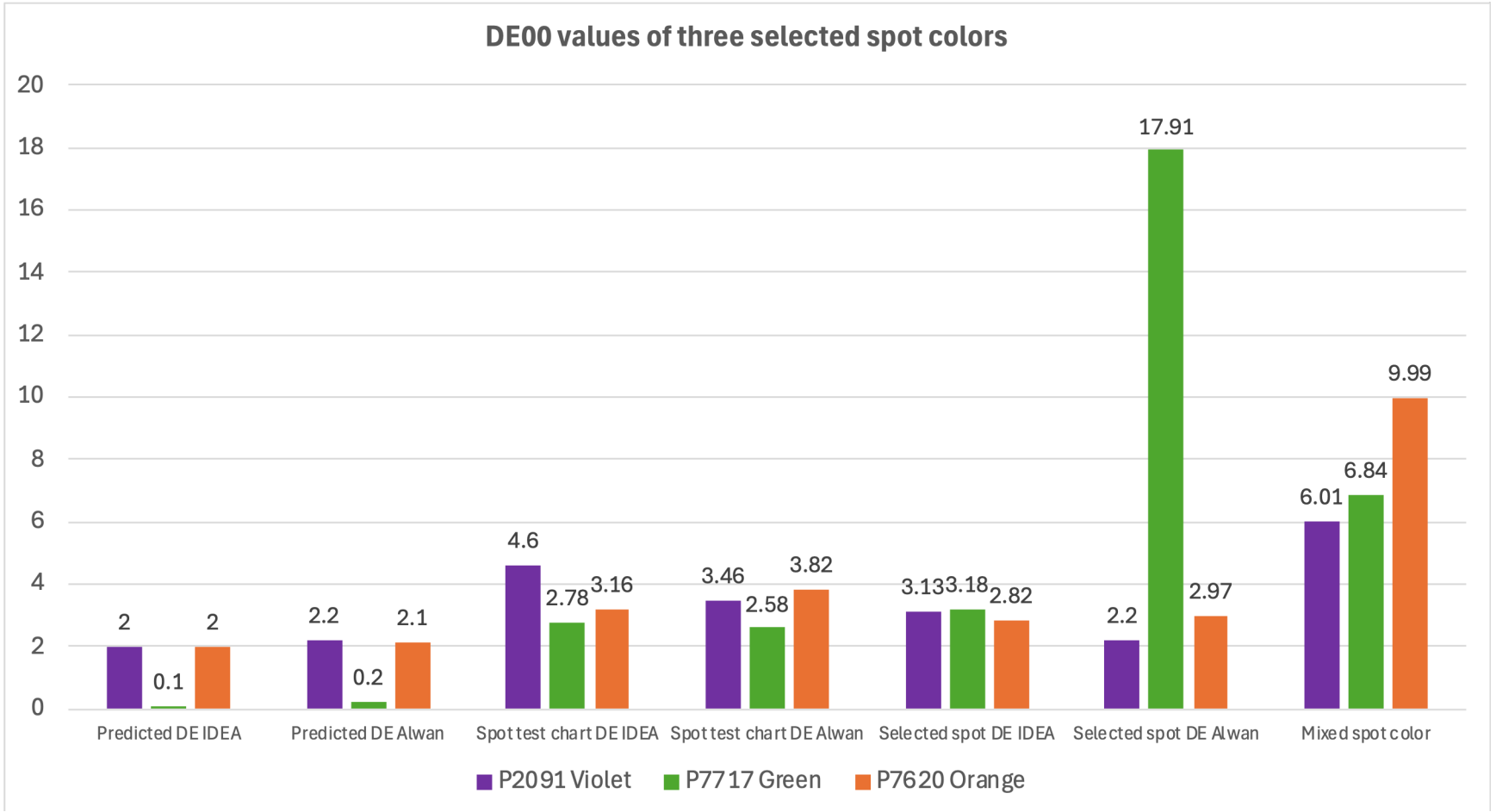


Image source: www.pantone.com

Results (Three selected spot colors)



Alwan 906p chart

Pantone 151 C			58.5		75.9		
Pantone 2091 C	25.7						97.9
Pantone 697 C		94.5		50.6	30.5		
Pantone 198 C		100		5.1	32.8		
Pantone 2475 C		3.7		42.7	9.7		
Pantone 7620 C		100		23.2	80.5		
Pantone 7413 C			52.4	13.4	47.6		
Pantone 2008 C		45.7	3.7	11.5			
Pantone 2002 C		53.5		3.5			
Pantone 600 C		38.1					0.3
Pantone 7493 C			21.3	14.6		4.6	
Pantone 7485 C			10.3	1.8		5.4	
Pantone 7742 C			62.2	50		28	
Pantone 7739 C			73.1	15.8		37.8	
Pantone 7483 C			52.4	62.2		40.2	
Pantone 348 C			62.2	25.6		53.6	
Pantone 2248 C			11.5	7.9		23.1	
Pantone 330 C	100			13.8			37.3
Pantone 7717 C	41.5			21.9		41.5	
Pantone 7710 C	56.1		3.6		15.8		
Pantone 443 C	4.8			37.8		3.7	
Pantone 550 C	31.7			9.8			
Pantone 2108 C	17.7			15.5			36.9
Pantone 5275 C	10.9			46.3			46.3
Pantone 5245 C		6.8		1.3			5.5
Pantone 2082 C		31.1		7.3			57.9
Pantone 7661 C		26.2		12.2			40.2
Pantone 7430 C		34.4		3.1			2.1
Pantone 2045 C		81.1		3.7	2.7		

Alwan optimized 180p chart

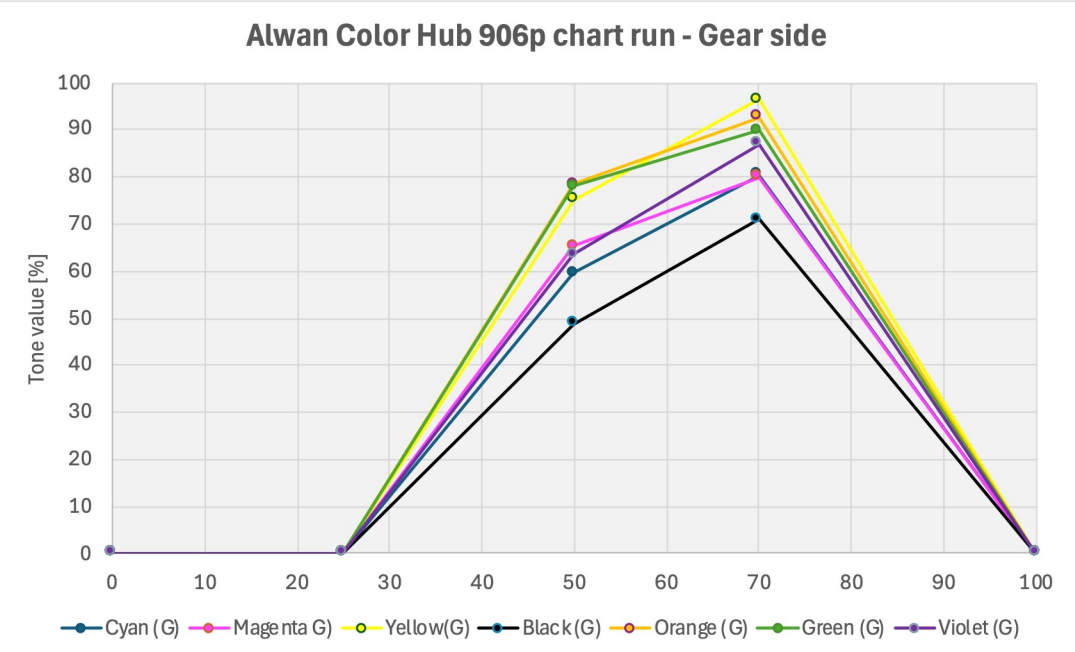
		73.8		86.3		
21.5						98.5
	95.1		45.1	30.5		
	100		4.6	32.4		
	2.1		39	10.3		
	100		24.3	97.6		
		62.2	10.9	47.6		
		51.2	2.4	12.2		
		57.3		3.5		
		45.1			0.6	
		24.4	12.2		4.8	
		10.3	1.2		5.4	
		73.2	45.7		30.5	
		79.3	13.4		40.2	
		57.3	60.4		41.5	
		71.9	26.8		56.1	
		12.2	6.1		23.1	
25.6			63.4		45.1	
37.2			20.7		42.1	
51.2			2.4		15.8	
3.9			35.7		3.6	
28			9.7			
15.2			11			39
8.5			40.2			47.6
39.7			85.1			100
	28		5.4			58.9
	22.2		9.2			41.5
	31.7		1.2			3.1
	81.7		2.4	2.4		

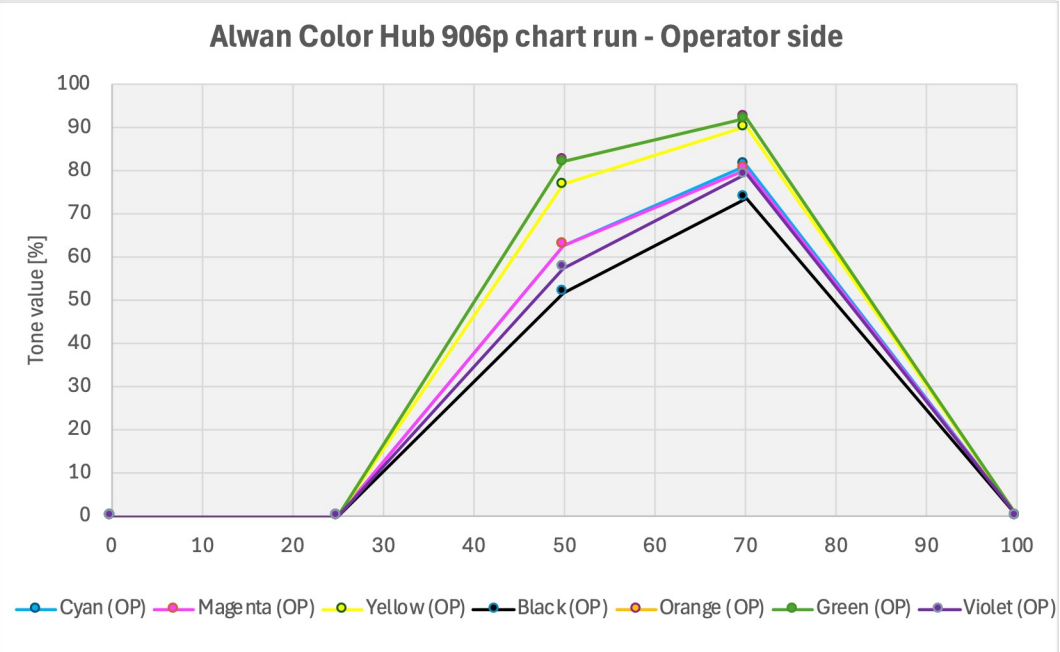
TAGA NextGen

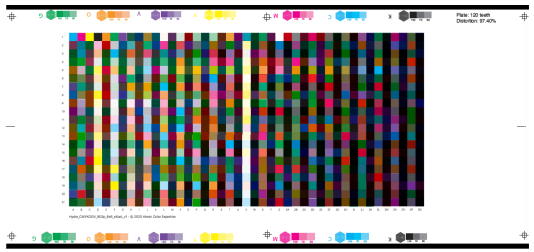
Results

SCTV curves

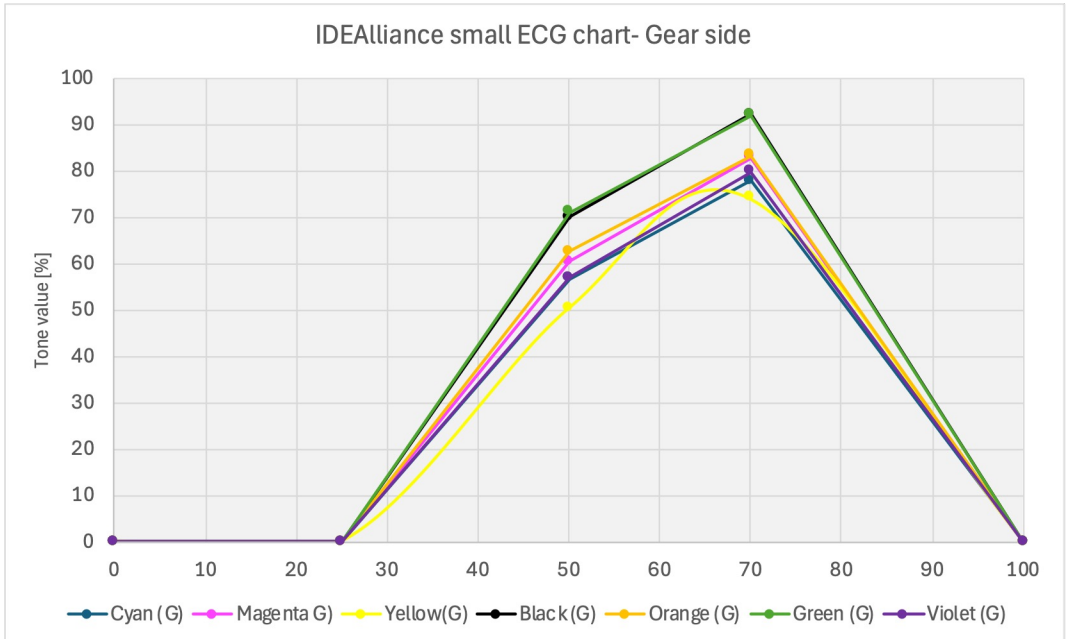
SCTV curves – Alwan 906p chart

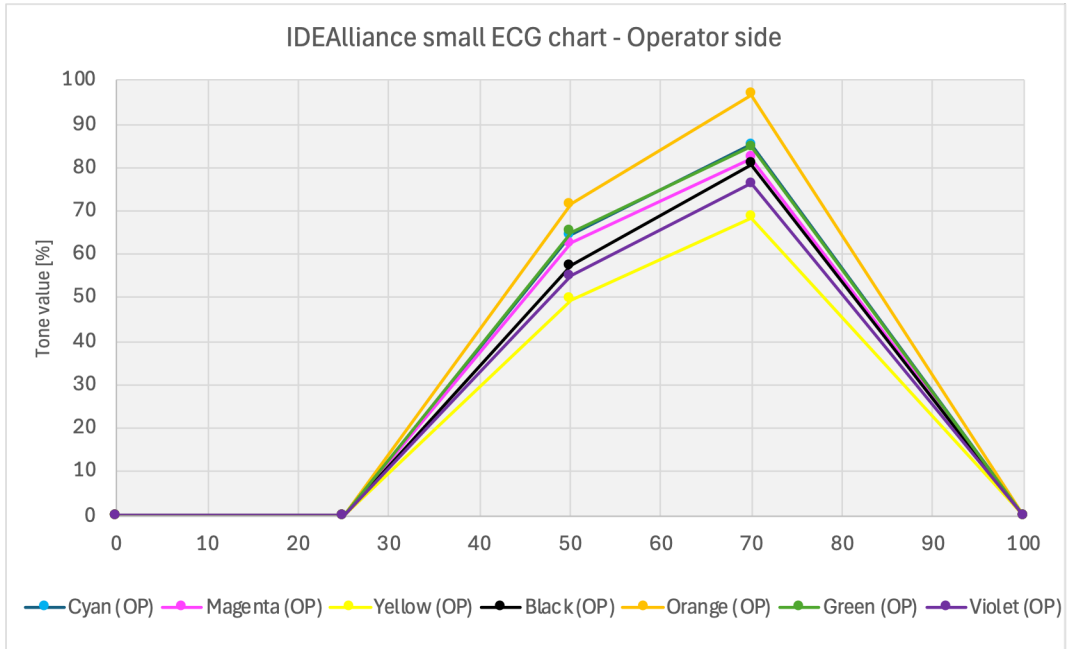


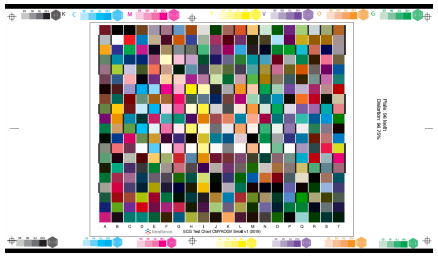




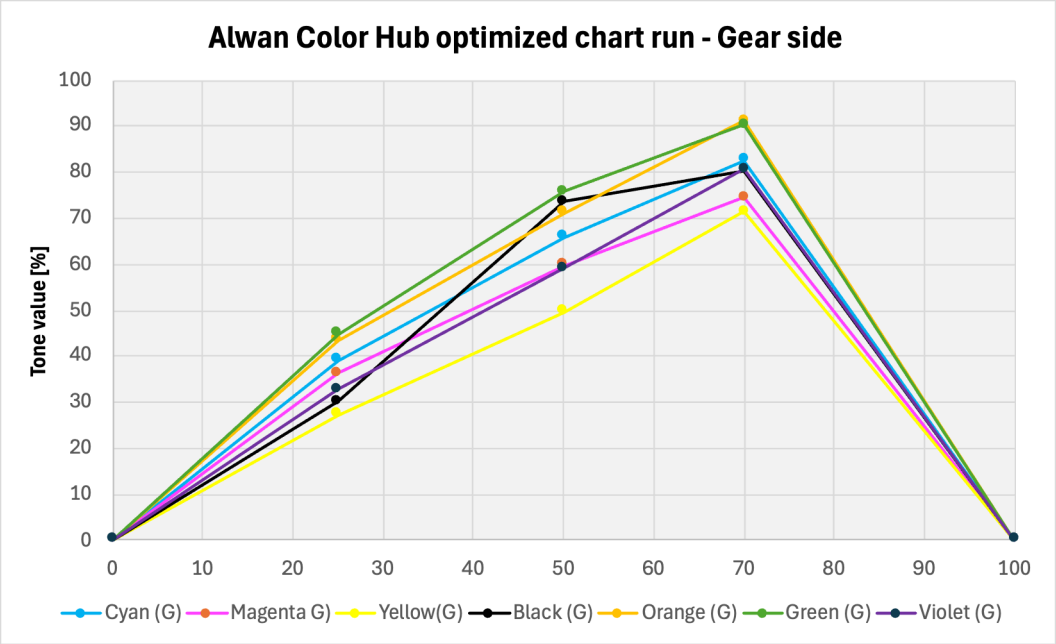
SCTV curves – IDEAlliance small ECG chart

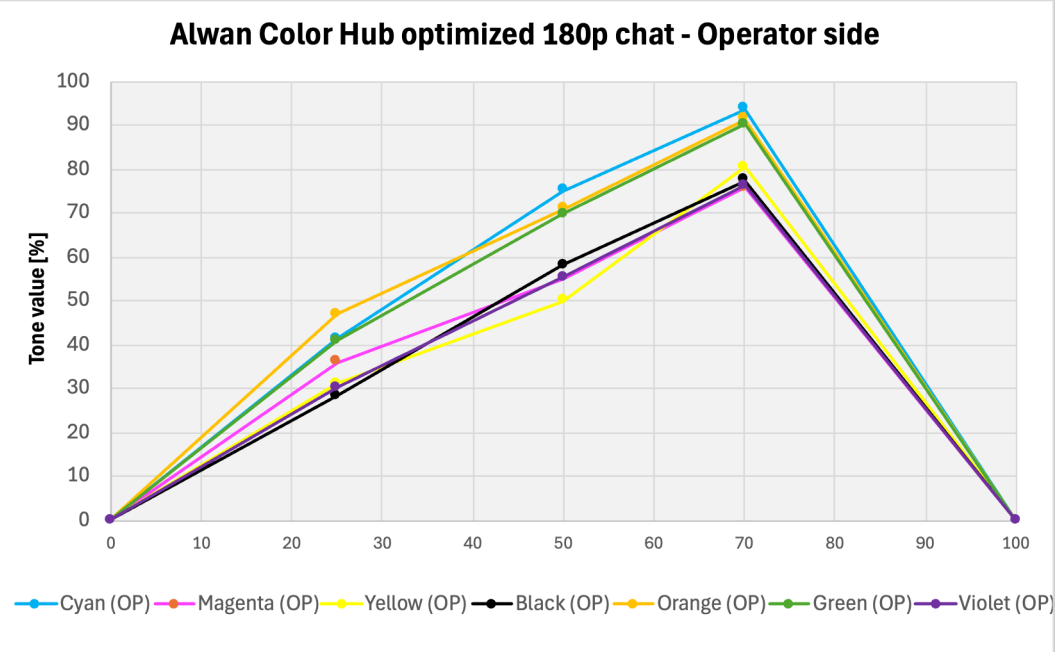


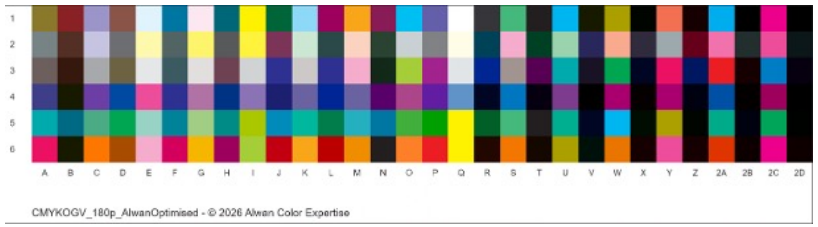




SCTV curves – Alwan optimized chart 180p







TAGA NextGen

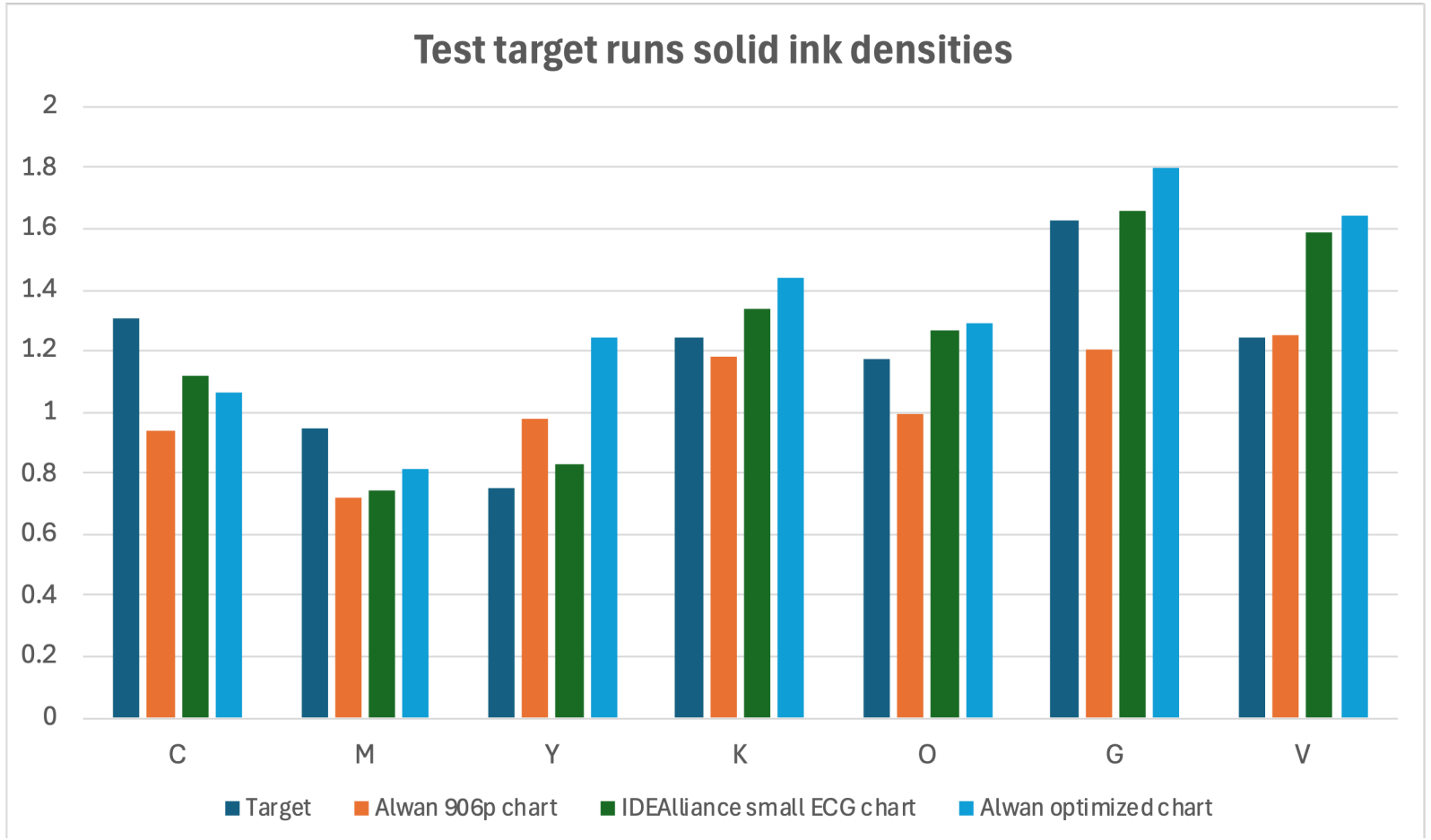
Results

Solid ink densities & Print contrast

TAGA NextGen

2026

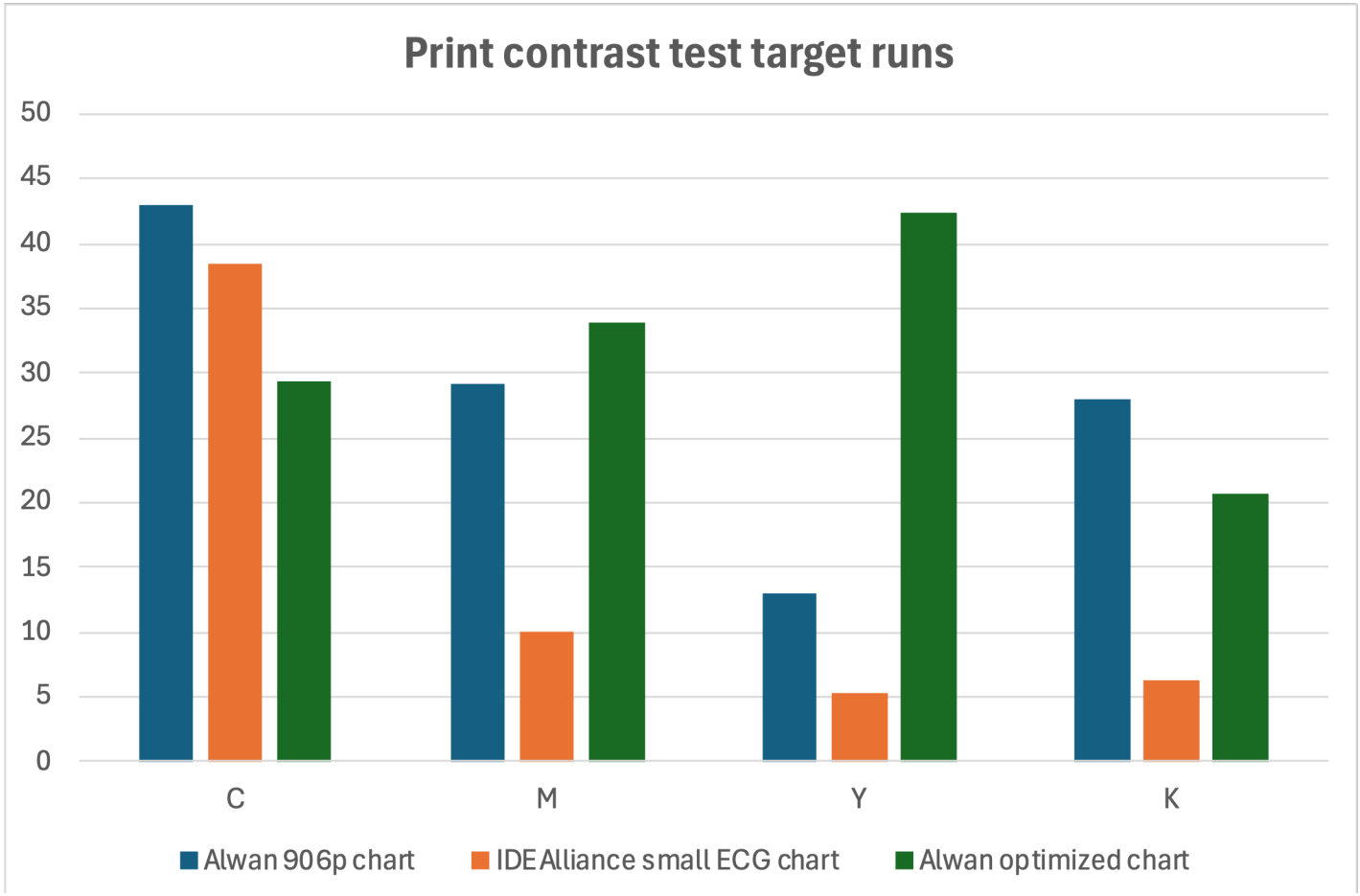
Solid ink densities



TAGA NextGen

2026

Print contrast – test target runs



TAGA NextGen

Results

Ink mixing & Test runs comparison

Ink mixing

Three PMS colors were selected:

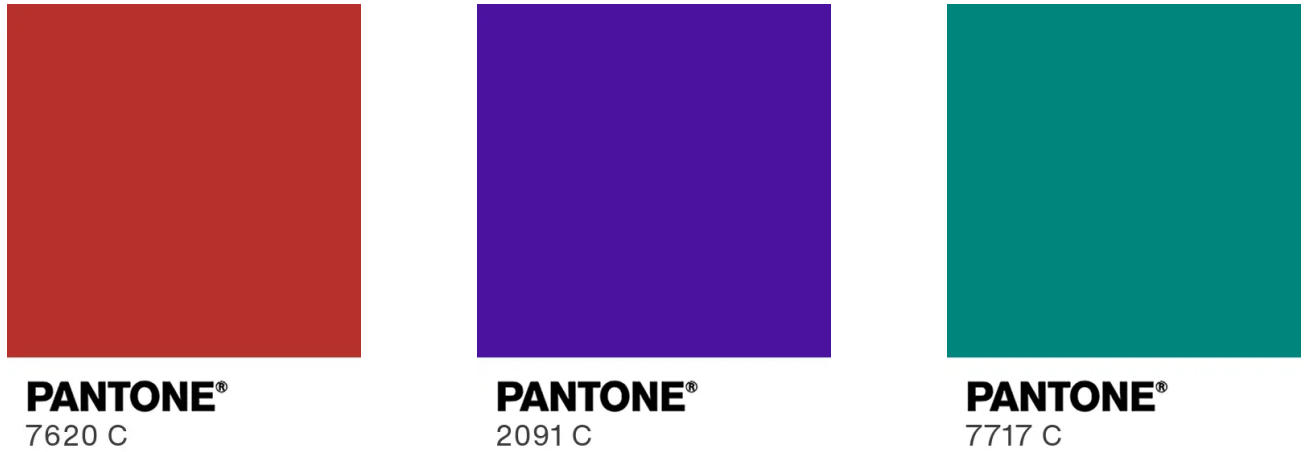


Image source: www.pantone.com

PMS7620

- CIE L*a*b D50/2° M1
- ΔE 2000
- Pantone Library Data

1 BCM/in² = 1.55 cm³/m²

LPI/BCM	Recipe	Base	Base	Base	1	2	2	3	**4**	4
	Anilox	360/3.5	360/4.5	360/5.5	360/5.5	360/5.5	260/6.0	360/5.5	**360/5.5**	260/6.0
	ΔL	0.26	0.39	-3.11	-2.31	-0.89	-6.94	-2.38	**-1.08**	-6.00
	Δa	-9.73	-9.50	-7.03	-7.18	-7.88	-6.16	-7.70	**-8.00**	-6.74
	Δb	-11.98	-11.91	-8.13	-7.43	-7.56	-4.43	-5.61	**-5.41**	-3.57
	ΔE	5.00	4.97	4.33	3.67	3.20	6.44	3.32	**2.73**	5.70

7620	Base [g]	1	2	3	4	Final [g]	Final [%]
Rubine Red	48.5					48.5	42.06
Yellow	36.5	1.7	2.0	2.5	2.8	45.5	39.46
Transparend White	12.8					12.8	11.10
Black	2.2					2.2	1.91
Water	6.3					6.3	5.46
SUM	106.3					115.3	100.0

1 BCM/in² = 1.55 cm³/m²

PMS2091

- CIE L*a*b D50/2° M1
- ΔE 2000
- Pantone Library Data

LPI/BCM	Recipe	Base	1	2	3	4	5	6	7	**7**	7
	Anilox	260/8.0	260/8.0	N/A	260/8.0	260/8.0	260/8.0	260/8.0	260/8.0	**360/5.5**	360/3.5
	ΔL	9.55	7.70		0.08	-0.07	-1.02	6.56	-4.55	**-1.30**	2.33
	Δa	-12.63	-15.40		-13.06	-15.17	-14.97	-20.20	-19.62	**-19.32**	-20.05
	Δb	24.67	23.00		23.74	22.31	22.26	19.70	21.50	**20.19**	20.31
	ΔE	10.75	9.09		7.35	6.67	6.7	8.39	7.58	**6.63**	6.97

2091	Base [g]	1	2	3	4	5	6	7	Final [%]
Purple	49.5			49.5			49.5	74.3	68.8
Transparend White	41.0			16.2					
Process Blue	9.6	2.3	5.2	10.3	2.0		17.1	25.7	23.8
Violet						2.1			
Water	8.8			8.0			7.8	8.0	7.4
SUM	108.9			84.0				108.0	100.0

1 BCM/in² = 1.55 cm³/m²

PMS7717

- CIE L*a*b D50/2° M1
- ΔE 2000
- Pantone Library Data

LPI/BCM

Recipe	Base	Base	1	2	**3**
Anilox	360/5.5	360/3.5	360/3.5	360/3.5	**360/3.5**
ΔL	-14.78	-9.89	-8.74	-5.29	**-4.84**
Δa	5.21	4.23	3.91	2.14	**0.13**
Δb	-7.81	-9.06	-7.84	-4.76	**-0.95**
ΔE	14.20	10.83	9.62	5.92	**4.65**

7717	Base [g]	1	2	3	Final [g]	Final [%]
Process Blue	53.0				53.0	48.9
Transparend White	36.0				36.0	33.2
Yellow	6.8	0.7	2.3	2.7	12.5	11.5
Black	4.2				4.2	3.9
Water	2.7				2.7	2.5
SUM	102.7				108.4	100.0

Pantone book as a color standard

	7620	2091	7717
ΔL	0.13	1.78	0.72
Δa	0.40	-12.44	-2.60
Δb	1.71	11.58	-0.67
ΔE	**0.81**	**4.50**	**1.12**

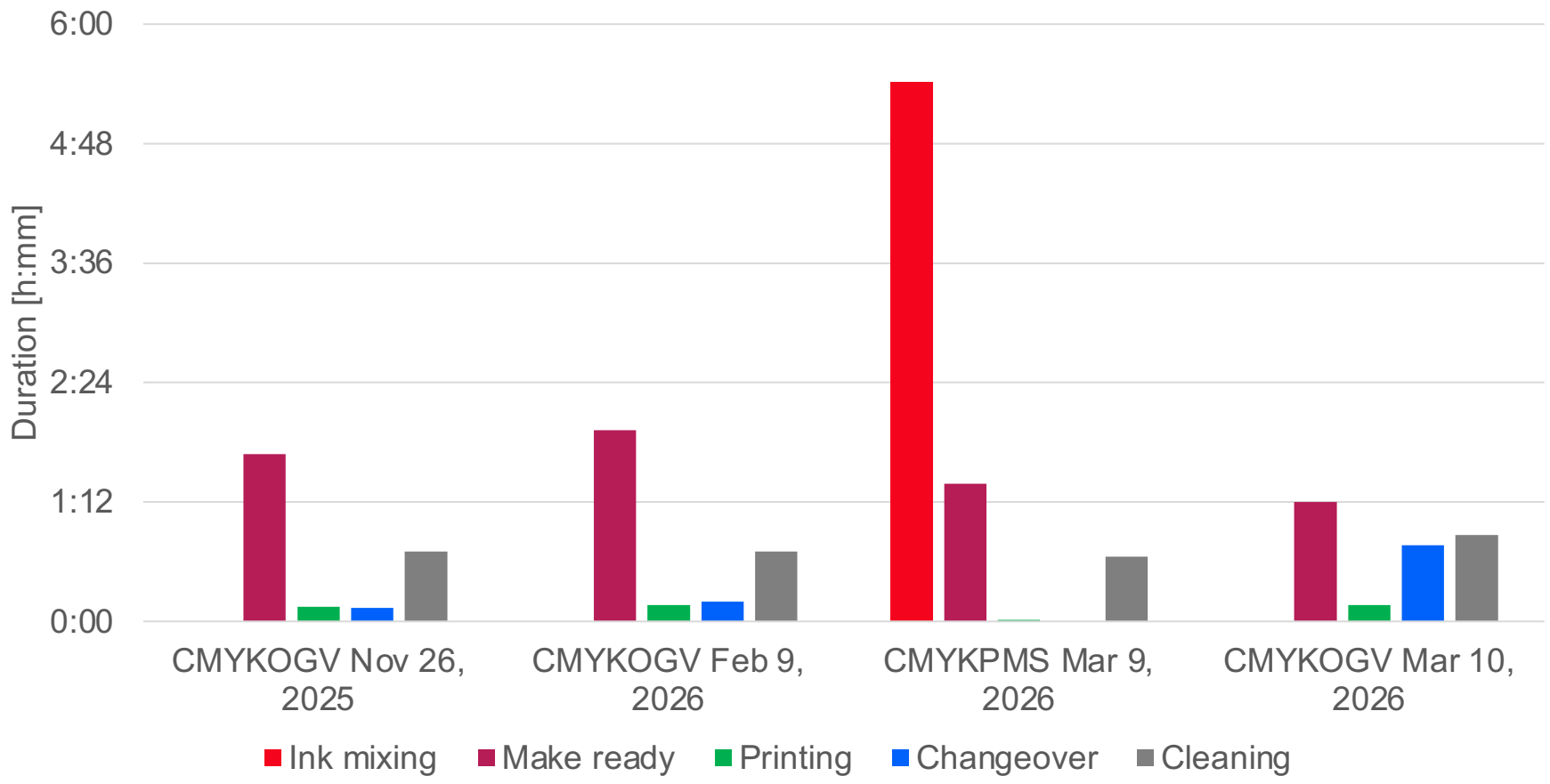
Test Runs Comparison

	Production log November 26, 2025	Production log February 9, 2026	Production log March 9, 2026	Production log March 10, 2026
	CMYKOGV	CMYKOGV	CMYK+3PMS	CMYKOGV
Activity	Duration [h:mm]			
Ink mixing	0:00	0:00	**5:25**	0:00
Make ready	1:41	1:55	1:23	1:12
Printing	0:09	0:10	0:01	0:10
Changeover	0:08	0:12	0:00	0:46
Cleaning	0:42	0:42	0:39	0:52
TOTAL	2:40	2:59	**7:28**	3:00

Test Runs Comparison

	Production log November 26, 2025		Production log February 9, 2026		Production log March 9, 2026		Production log March 10, 2026	
	CMYKOGV		CMYKOGV		CMYKPMS		CMYKOGV	
Activity	Duration		Duration		Duration		Duration	
	[h:mm]	[%]	[h:mm]	[%]	[h:mm]	[%]	[h:mm]	[%]
Ink mixing	0:00	0.0%	0:00	0.0%	**5:25**	**72.5%**	0:00	0.0%
Make ready	1:41	63.1%	1:55	64.3%	1:23	18.5%	1:12	40.0%
Printing	0:09	5.6%	0:10	5.6%	0:01	0.2%	0:10	5.6%
Changeover	0:08	5.0%	0:12	6.7%	0:00	0.0%	0:46	25.6%
Cleaning	0:42	26.3%	0:42	23.4%	0:39	8.7%	0:52	28.9%
TOTAL	2:40		2:59		**7:28**		3:00	

Test Runs Comparison



Key Findings & Conclusions

- A larger test target does not necessarily mean a larger color gamut
- The color gamut of the profiles is similar
- Alwan’s optimized chart results in different color builds of the selected test colors
- Standarization of printing inks [CMYKOGV] is essential
- Supply Quality Control or verified ink suppliers

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CPIS The Centre for Packaging Innovation and Sustainability