

ISO STANDARDS NEW TECHNOLOGIES FOR PACKAGING PRINTING

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ISO TC130/WG13 Convener

PACKAGING - COLOR IS FUNDAMENTAL!

- Average supermarket shopper is exposed to 42.000 products during a 30 minutes shopping
- 60% are impulse purchases
- 80% of purchasing decisions are made in the store
- The decision to pick up a package is made in less than 3 seconds
- Color is the main ingredient in this equation!

VERY IMPORTANT STANDARDS

Viewing	ISO 3664
Observer	ASTM E1499
Instrument	ISO 13655
File Format	ISO 15930 – series (PDF/X-4) 1.7 PDF/X-6 (ISO 32000)
Paper/Substrates	ISO 15937
Proofing	ISO 12647-7/8, ISO 12646, ISO 14861
Workflows	ISO TS 10128 / CGATS.21
TVI curve correction	ISO 18620:2016 (TVI curve exchange)
TVI assessment	ISO 5, ISO 20654 (SCTV)
Printing	ISO 12647 and ISO 15339 families
Inks	ISO 2846, CxF/x-4, ISO 17972-4
Process Control	ISO 12647 & ISO 19302

PREPRESS
DEFINING
CORRECTLY
FROM THE
BEGINNING...



ILLUMINATION/MEASURING METHOD

ISO 13655 - OUR PAPER HAS OBA!

ISO 3664:2009 (M1)



M0: legacy 

M1: defined UV: D50 

M2: UV-excluded

M3: polarized

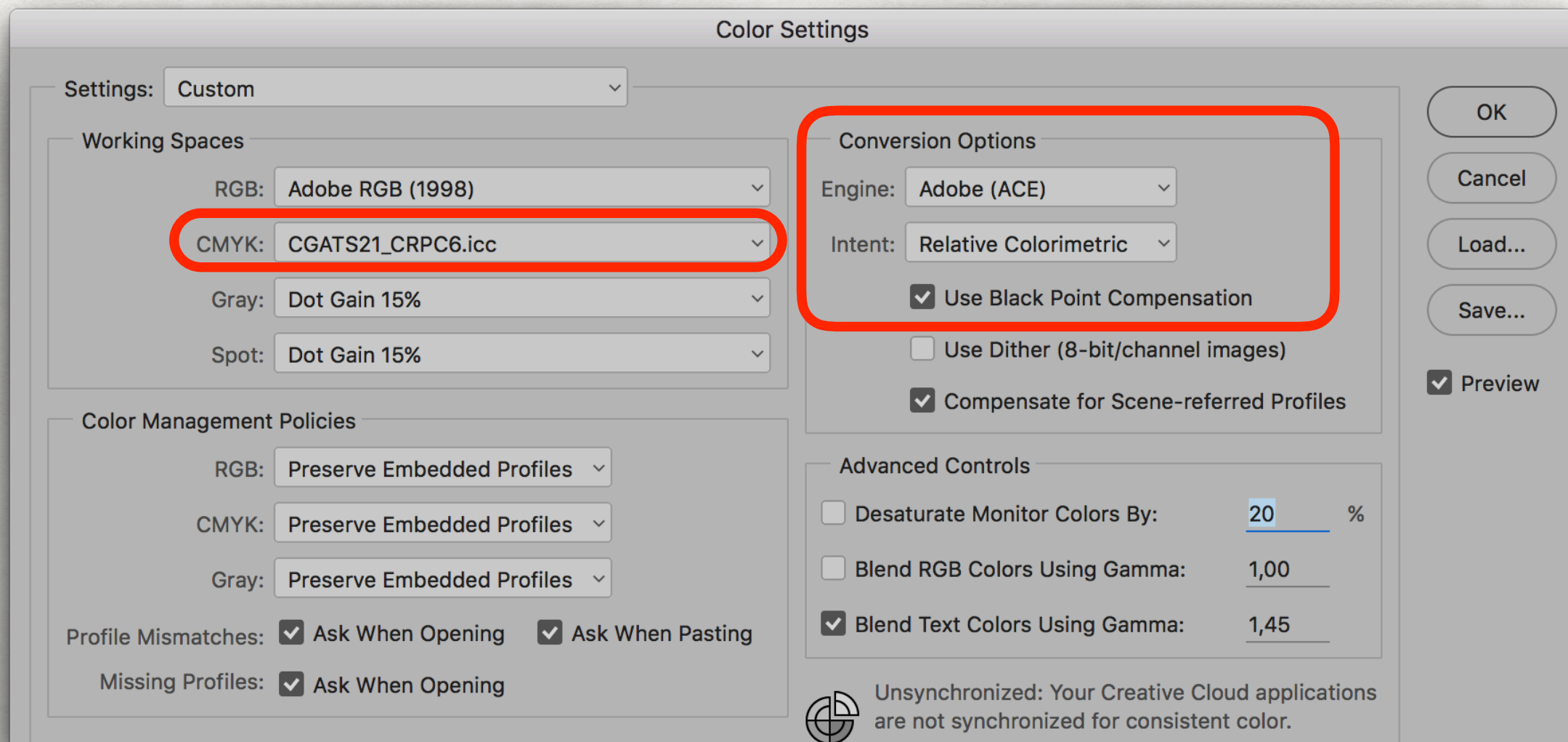


M1

STANDARD PRINTING CONDITIONS

ISO 12647-2:2013

- G7 gray balance based - CRPC 1 to 7
- TVI curve based - Fogra51, Fogra52 and others that will be published



PDF/X-4

THE ACTUAL STANDARD IN PACKAGING

- ISO 15930-8
- Based on Adobe PDF 1.6
 - Support for transparency, spot color, one output intent, layers, RGB, Lab, Gray, CMYK with profile
 - Doesn't support Multicolor profiles (cannot embed them)
 - Doesn't support in a standardized way CxF/X-4
 - The market is taking years to "absorb" the new features and this is a very good compromise format
 - BUT...

PDF/X-6

THE SUCCESSOR OF PDF/X-4

- ISO/CD 15930-9 Graphic Technology — Prepress digital data exchange using PDF — Part 9: Complete exchange of printing data (PDF/X-6)
- **First graphic arts PDF/X based on ISO 32000-2**
- Support for transparency, embedded Cxf/X-4 spot color, multiple output intents per doc (page), N-Color capability, and multi-platform support

PDF/X-6

THE SUCCESSOR OF PDF/X-4

- 3 levels of conformity:
 - PDF/X-6
 - PDF/X- 6p (externally referenced ICC profiles)
 - PDF/X-6n (n-channel color spaces CMYK + Orange, Green, Violet)
 - PDF/X-6n is very important for driving content to new conventional multicolor and ink jet presses using n-channel color spaces
 - PDF 2.0 will allow embedding n-channel ICC profile, which will be the basis for PDF/X-6n (today is not permitted/possible)

CXF/X-4

PRECISE DEFINITION OF SPOT COLORS

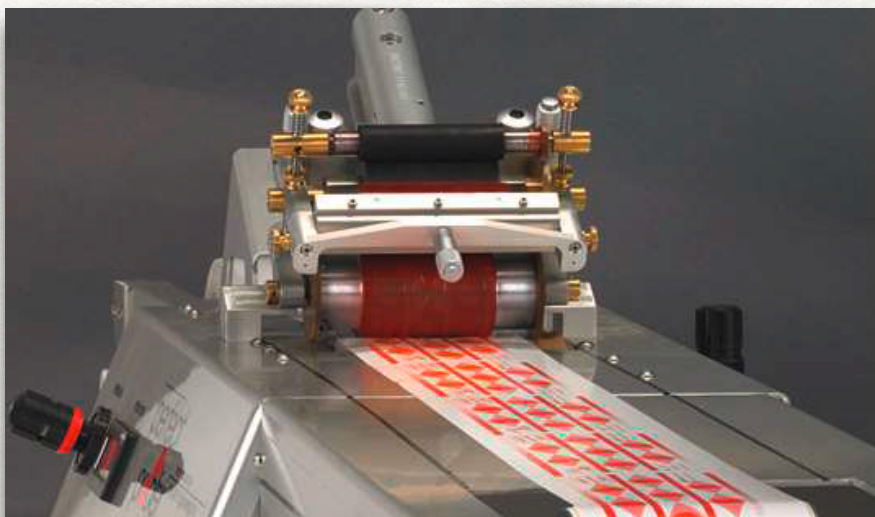
- ISO 17972-4 - Graphic technology — Colour data exchange format (CxF/X) — Part 4: Spot colour characterisation data (CxF/X-4)
 - defines an exchange format for spectral measurement data of inks to provide a means to characterize spot colour inks and to exchange data about spot colors
 - will be used in PDF/X environments
 - define spot or process for multicolor process with precise transparency and SCTV (tone value increase)

CXF/X-4

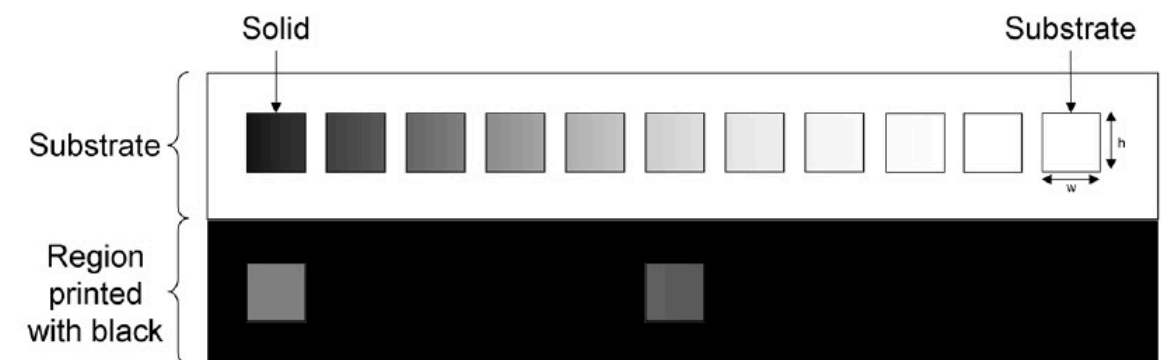
PRECISE DEFINITION OF COLOR (SPOT AND PROCESS)

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<?xml version="1.0" encoding="UTF-8"?>
<cc:CxF xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:cc="http://colorexchangeformat.com/CxF3-
core" xmlns:sic="http://colorexchangeformat.com/CxF3-SpotInkCharacterisation"
xmlns:qc="http://colorexchangeformat.com/CxF3-qualitycontrol" xsi:schemaLocation="http://
colorexchangeformat.com/CxF3-core CxF3_Core.xsd">
  <cc:FileInformation>
    <cc:Creator>ORIS CxF Toolbox, Version 1.1.0.9, Link date 9/5/2016 3:05:14 PM</cc:Creator>
    <cc:CreationDate>2016-09-19T22:41:22+00:00</cc:CreationDate>
    <cc:Description>No description supplied</cc:Description>
  </cc:FileInformation>
  <cc:Resources>
    <cc:ObjectCollection>
      <cc:Object ObjectType="Standard" Id="A1" Name="A1">
        <cc:CreationDate>2016-09-19T22:39:53+00:00</cc:CreationDate>
        <cc:ColorValues>
          <cc:ReflectanceSpectrum ColorSpecification="CS001"> 0.6693 0.7224 0.7597
0.7881 0.8076 0.8211 0.8286 0.8374 0.8478 0.8539 0.8567 0.8611 0.8651 0.8677 0.8724 0.8749 0.8776 0.8801 0.8801
0.8841 0.8834 0.8843 0.8874 0.8886 0.8882 0.8888 0.89 0.8864 0.8895 0.8956 0.8964 0.8953 0.8989 0.9018 0.9017
0.9068</cc:ReflectanceSpectrum>
        </cc:ColorValues>
      </cc:Object>
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        <cc:CreationDate>2016-09-19T22:39:53+00:00</cc:CreationDate>
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Developed to align with customer
requirement - Actual INKS!



source: Steve Smiley



Spectral reading over white and over black

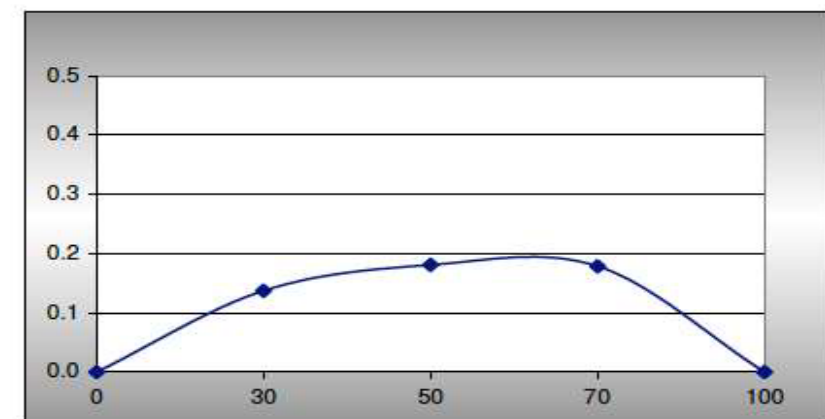
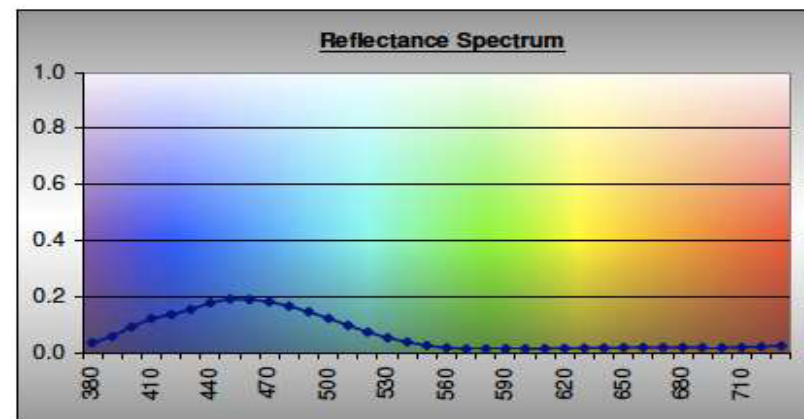
CFX/X4 SPECTRAL COLOR DEFINITION

PRECISE DEFINITION OF COLOR (SPOT AND PROCESS)

Spot Color Definition

Birdseye 294 Redesign

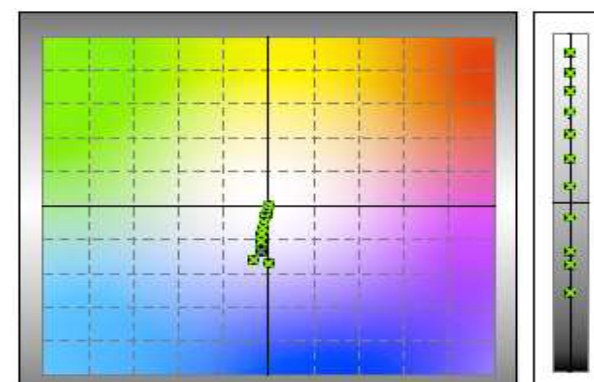
Spectral Data		
	Over White	Over Black
380	0.0345	0.0176
390	0.0569	0.0184
400	0.0916	0.0188
410	0.1209	0.0184
420	0.1352	0.0173
430	0.1539	0.0169
440	0.1772	0.0165
450	0.1910	0.0161
460	0.1897	0.0155
470	0.1807	0.0149
480	0.1655	0.0141
490	0.1453	0.0133
500	0.1217	0.0125
510	0.0967	0.0116
520	0.0726	0.0106
530	0.0525	0.0096
540	0.0371	0.0088
550	0.0246	0.0080
560	0.0163	0.0076
570	0.0132	0.0078
580	0.0133	0.0085
590	0.0135	0.0088
600	0.0136	0.0091
610	0.0143	0.0096
620	0.0152	0.0103
630	0.0159	0.0106
640	0.0166	0.0110
650	0.0175	0.0111
660	0.0184	0.0110
670	0.0187	0.0107
680	0.0181	0.0106
690	0.0177	0.0106
700	0.0176	0.0112
710	0.0186	0.0124
720	0.0207	0.0134
730	0.0237	0.0145



Spot Over White							
Dot %	L	a	b	C	H	TVI	
0	94.62	0.27	0.35	0.44	52.6	0%	
10	88.40	-0.48	-2.69	2.73	259.8	17%	
20	82.97	-1.17	-5.58	5.71	258.2	31%	
30	77.05	-1.85	-8.70	8.89	258.0	44%	
40	70.30	-2.63	-12.39	12.66	258.0	57%	
50	63.11	-3.38	-16.47	16.81	258.4	68%	
60	54.93	-3.91	-20.92	21.28	259.4	79%	
70	45.58	-4.16	-26.36	26.69	261.0	88%	
80	35.71	-4.23	-33.77	34.03	262.9	95%	
90	31.69	-8.32	-40.11	40.96	258.3	98%	
100	23.32	-0.06	-42.80	42.80	269.9	100%	

Specs	
Opacity(Y ratio)	24%
Spectral Density	1.88
DotGain @ 50%	18%
Print Cont @ 70%	50%

Pigments	
Reflex Blue	
Pro Blue	
Blk	
-	



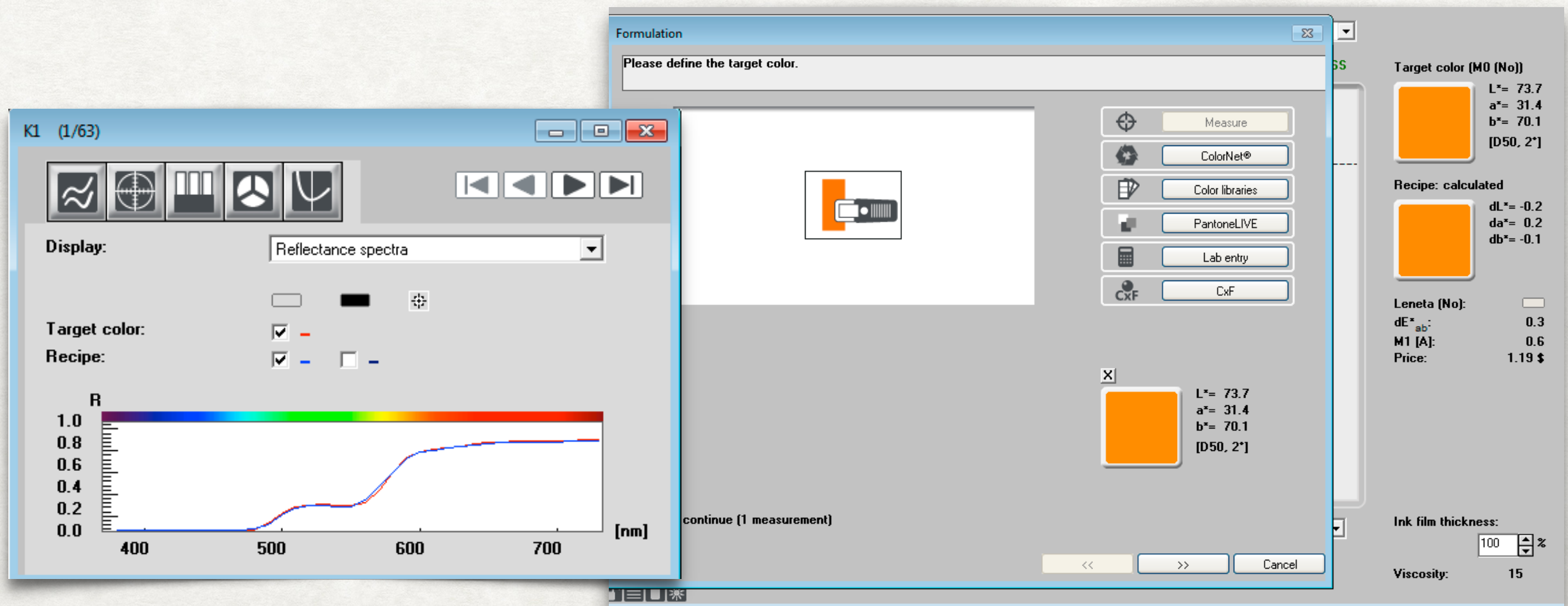
Birdseye 294 Redesign	
Brand Color	Birdseye 294 Redesign
Substrate	SBS
Backer	ISO 13655 White
Meas Device	Xrite SpectroEye (Certified: 12/2011)
Meas Conditions	5000K, 2°, No Filter
Geometry	0/45 (M0 - ISO13655)
Expiry Date	3/8/2013

Approved By	Color Engineering
Date	3/8/2012

CXF/X4

PRECISE DEFINITION OF COLOR (SPOT AND PROCESS)

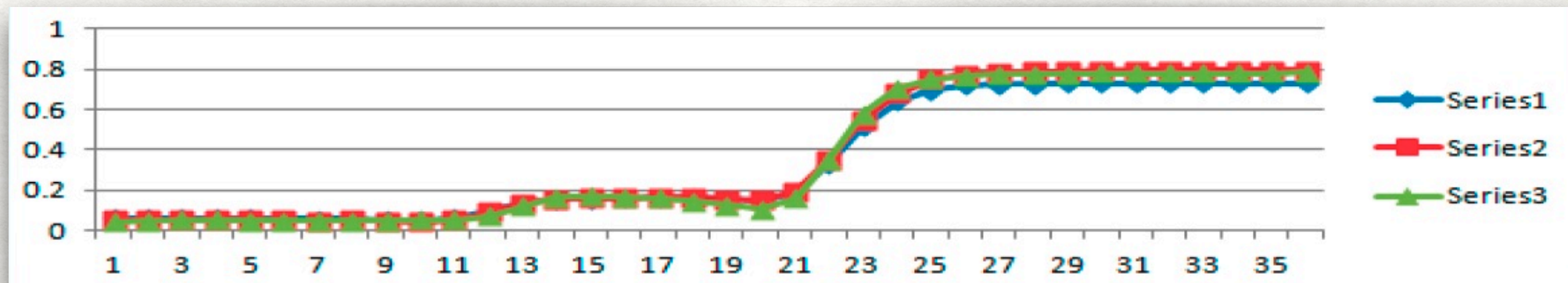
- CxF/X for Ink Formulation
- Use CxF/X for ink formulation – Lowest Metameric Index - (Same Ingredients)



CXF/X4

PRECISE DEFINITION OF COLOR (SPOT AND PROCESS)

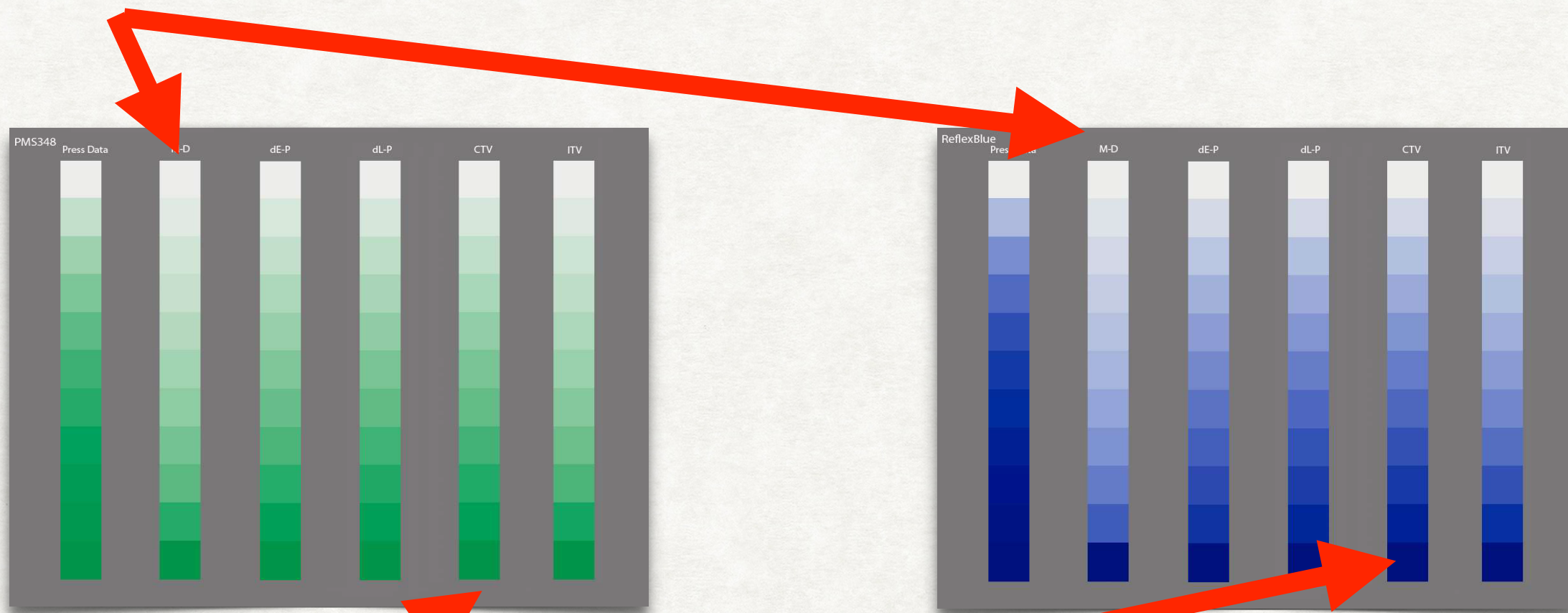
- Process control - in different processes



CFX/X-4 SPECTRAL COLOR WITH PROPER **TVI CONTROL**

TVI FOR CXF/X-4

Murray-davis densitometric TVI (ISO 5)



ISO 20654 – Spot Color Tone Value

ISO 20654 - SPOT COLOR TONE VALUE

MAKE THE TINTS BEHAVE!

- ISO/DIS 20654, Graphic Technology – Measurement and Calculation of Spot Colour Tone Value

$$SCTV = 100 \times \sqrt{\frac{(V_{xt}-V_{xp})^2 + (V_{yt}-V_{yp})^2 + (V_{zt}-V_{zp})^2}{(V_{xs}-V_{xp})^2 + (V_{ys}-V_{yp})^2 + (V_{zs}-V_{zp})^2}}$$

where

V_{xs}, V_{ys}, V_{zs} are V_x, V_y, V_z values calculated for the spot ink solid,

V_{xp}, V_{yp}, V_{zp} are V_x, V_y, V_z values calculated for the substrate and

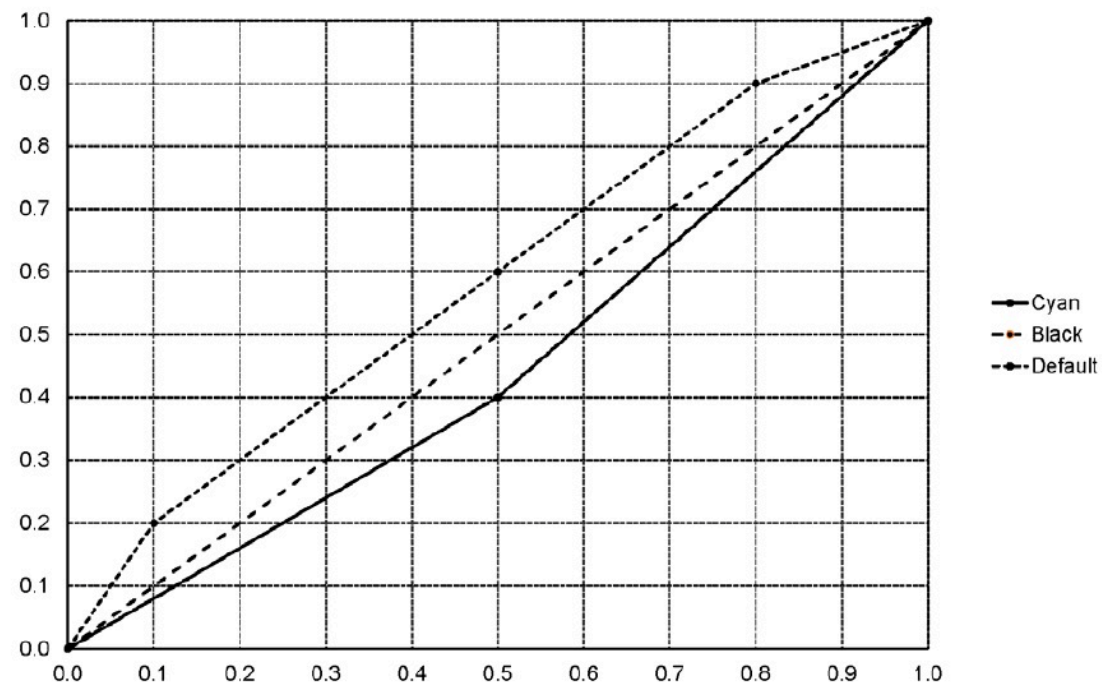
V_{xt}, V_{yt}, V_{zt} are V_x, V_y, V_z values calculated for the spot ink tone.

TVI CURVES - EXCHANGE

STANDARD ACROSS MANUFACTURER

- ISO 18620, Graphic Technology – Tone response curve adjustment

Figure 1 — Example curves



```
<?xml version="1.0" encoding="UTF-8"?>
<TransferCurveSet xmlns="http://www.npes.org/schema/ISO18620/"
  Creator="My Flexo Curve Tool"
  CreationDate="2014-10-09T17:08:30-05:00"
  OperatorName="Samuel Adams"
  PressName="My Printing Press"
  MediaName="Poly Plastic"
  Side="Front"
  MeasurementFile="<URL>"
  TransferCurveSetID="CRD-24-3">
  <FormPreparationDetails Description="Round dots screen"/>
  <PrintingCondition PrintingConditionID="CRPC-5"/>
  <TransferCurve Separation="Default"
    TransferCurveID="D123"
    Curve="0.0 0.0 0.004 0.0 0.004 0.1 1.0 1.0"/>
</TransferCurveSet>
```


ICC MAX

ICC NOW SPEAKS **SPECTRAL**



- Provides Support for the Packaging Industry
- Allows measurement data using the CxF format
- Spectral engine capable of calculating precise transformations for different illuminants
- New encoding of Named colors to support tints
- Brand owner can predict the metamerism over different illuminant of his packaging
 - Better pigments can produce less metameric results!

PRINTING
DIGITAL,
OFFSET,
FLEXO,
GRAVURE,
SILK



CMYK+SPOT

TVI BASED - VISUAL MATCH BETWEEN 2 CONFORM JOBS?

- **ISO 12647 family**
- Standardized materials (paper, ink primaries)
 - paper are likely not in conformance
 - Process control (TVI)
- The resulting colors are "in conformance"
- Spot in commercial range (only flat, no tints or overprints), agreement between buyer and producer

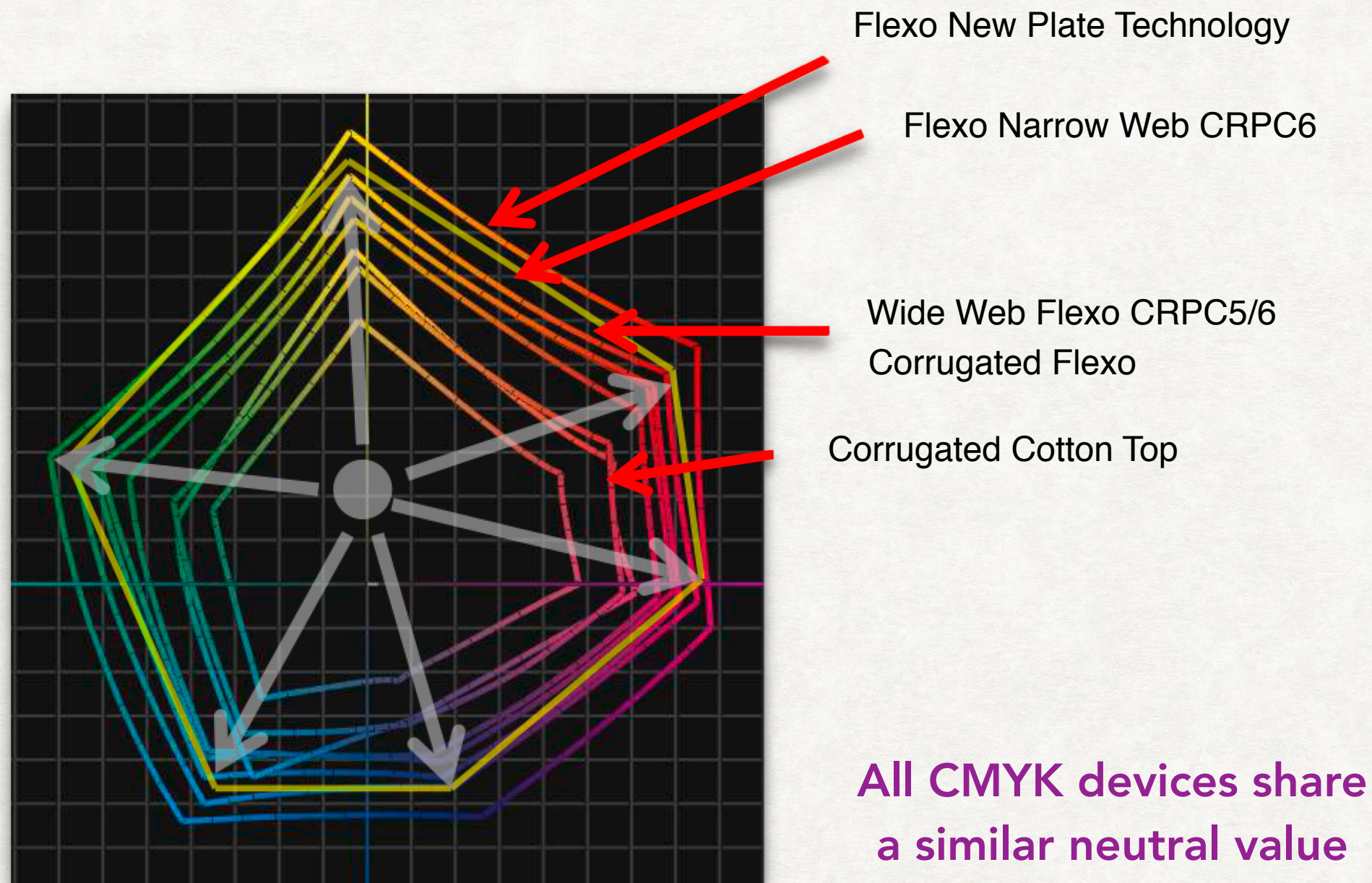
CMYK+SPOT

G7 BASED - VISUAL MATCH BETWEEN 2 CONFORM JOBS!

- **ISO 15339 family**
- Substrate adjusted - SCCA - Common appearance
- Standard ink
- Process control (G7) - Common appearance
- Printing process in conformance if...

ISO 15339 FAMILY

SUBSTRATE ADJUSTED - SCCA - COMMON APPEARANCE



ISO 15339 FAMILY

SUBSTRATE ADJUSTED - SCCA - COMMON APPEARANCE



CRPC1

CRPC2

CRPC3

CRPC4

CRPC5

CRPC6

CRPC7

Newspaper

Flexo uncoated

Wide Web Flexo
Corrugated Coated

Narrow Web Flexo
Flexo New Plate

Coldset

Improved News

Uncoated

SCA

Publication

Sheetfed

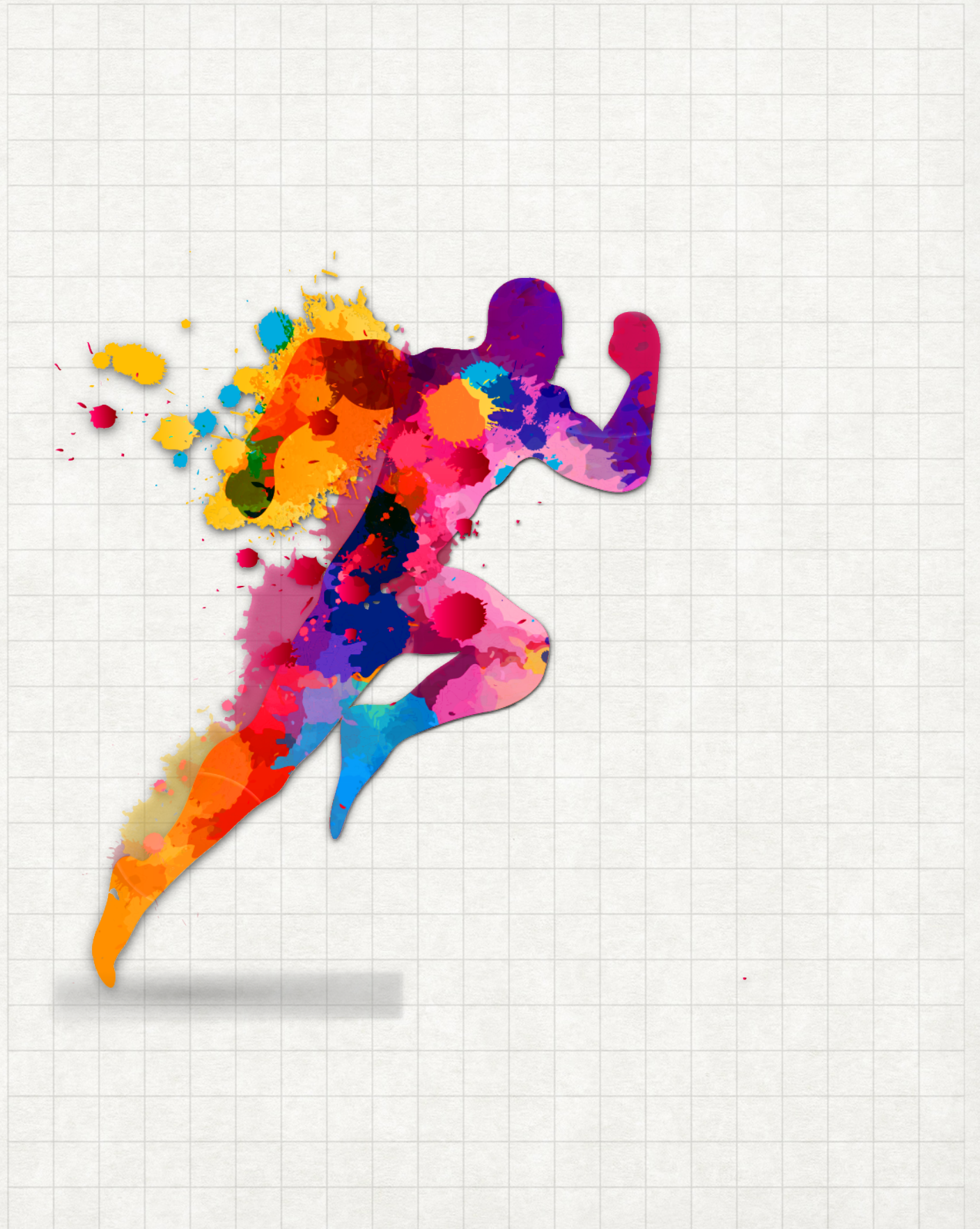
Digital

DIGITAL PRINTING

ISO 15311 FAMILY - UNDER DEVELOPMENT

- **ISO 15311 family**
- Print as a simulation of large anagopic printing condition: Fogra39
- Simulation of traditional printing
- Each the of product with its own quality level
- Still under heavy debate!

ECG
EXPANDED
COLOR GAMUT
PRINTING



EXPANDED COLOR GAMUT

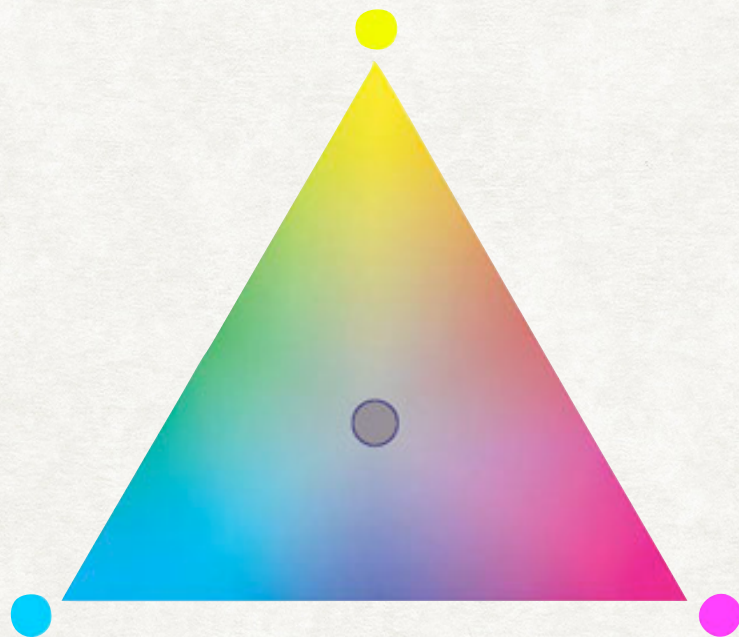
ECG

- inkset: CMYK+OGV+(W)
- substrate: depends on process
- process: Flexo, Offset, Gravure, Digital
- Problems to be solved on standardized way:
 - ink primaries: transparency, hue, sequence
 - color management (iCCMax): ICC has to be spectral because of huge profiles and need for fast transformations
 - iCCMax makes precise calculations for different illuminants over packaging
 - CxF/X-4 to predict overprint spot over spot (and primaries)

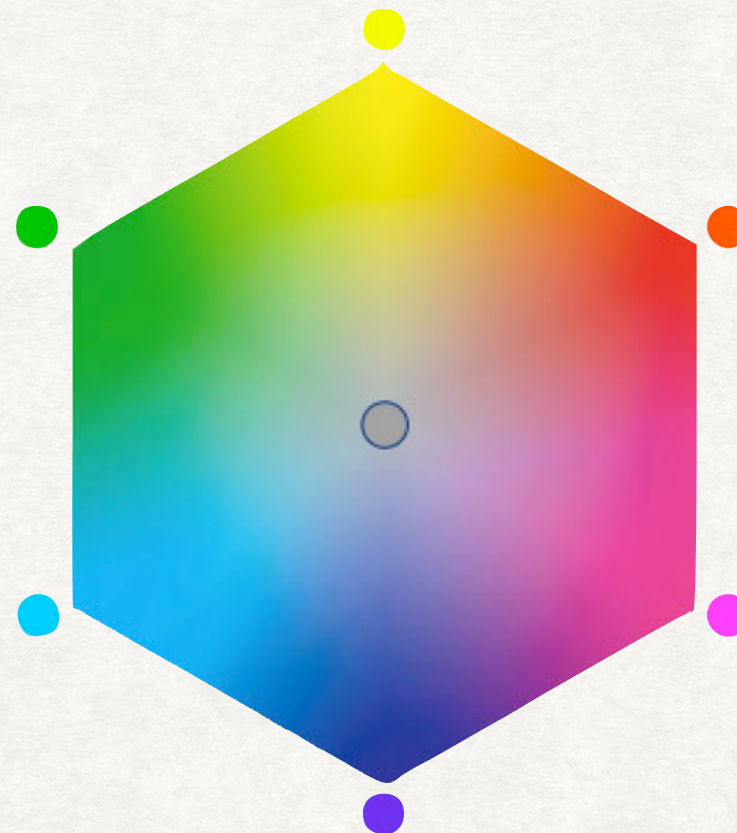
EXTENDED COLOR GAMUT

SPOT COLORS AS GOOD AS POSSIBLE!

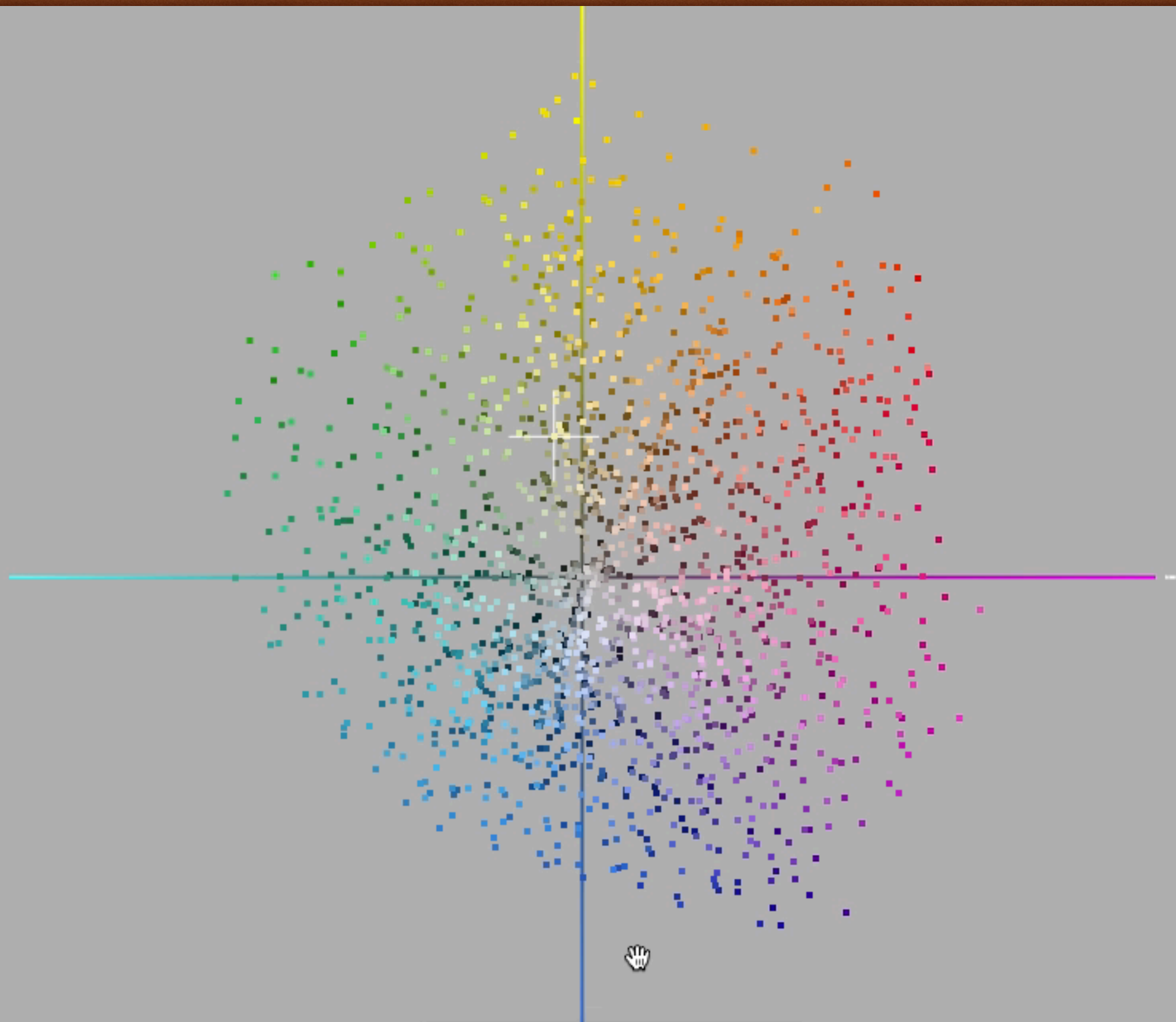
- HiFi Printing enables printers to add one or more inks (orange, green, blue or violet) to the conventional process inks (CMYK) in order to extend the color gamut of their press
- 85%+ of Pantone colors are in CMYKOGV gamut






CMYK



CMYKOGV

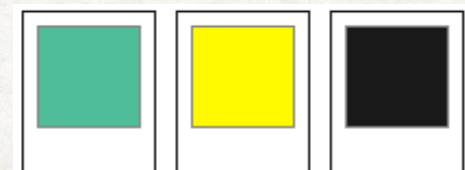
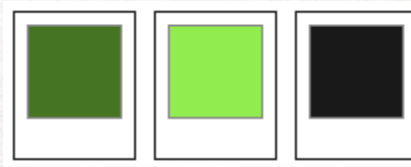
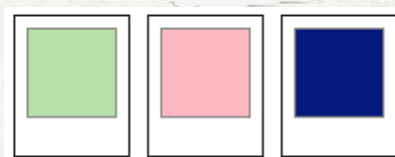
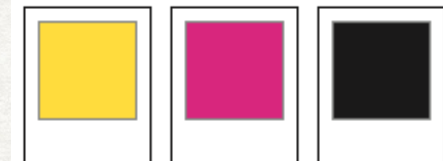
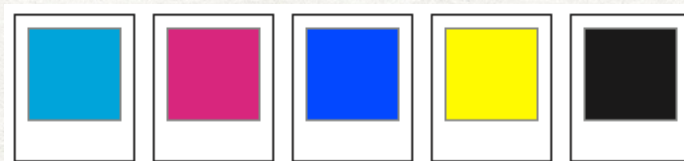


Plot Items		
Plot List		
<input checked="" type="checkbox"/>		1) PANTONE+ Solid Coated-V2_M1.txt
<input type="checkbox"/>	 Profile	ISO Coated v2 (ECI)
<input type="checkbox"/>	 Profile	VPack_OGVKCMY_Coated_Paper

SPOT COLOR PRINTING WITH SPOT INKS

ANY SPOT WITHOUT CHANGING INKS

- With spot inks these six products require CMYK + 9 spot inks



+



SPOT COLOR PRINTING WITHOUT SPOT INKS

COST, EFFICIENCY, SMALL RUNS

- With process inks these six products require CMYKOGV inks only!



• CMYKOGV



BENEFITS FOR PACKAGING AND LABEL PRINTERS

COST, EFFICIENCY, SMALL RUNS

- Meet customer expectations and requirements for a vast majority of jobs without using spot inks
- 6 labels can be printed in 1 job instead of 6
- 7 printing units instead of 13
- 1 Make Ready instead of 6
- Short runs become possible and profitable
- **Requires accurate color management and process control**



CUSTOMER
SATISFACTION

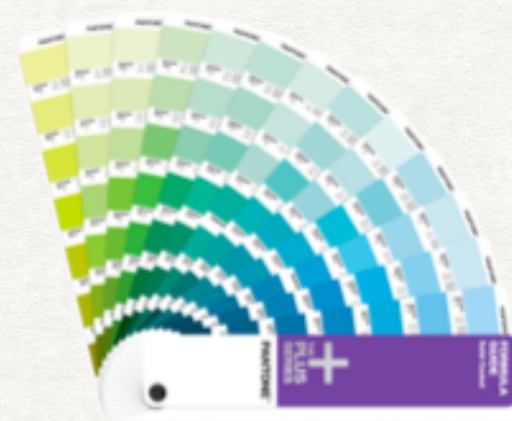
GET
WHAT HE
WANTS



PRINT BUYER COLOR SPECIFICATIONS

CXF/X-4

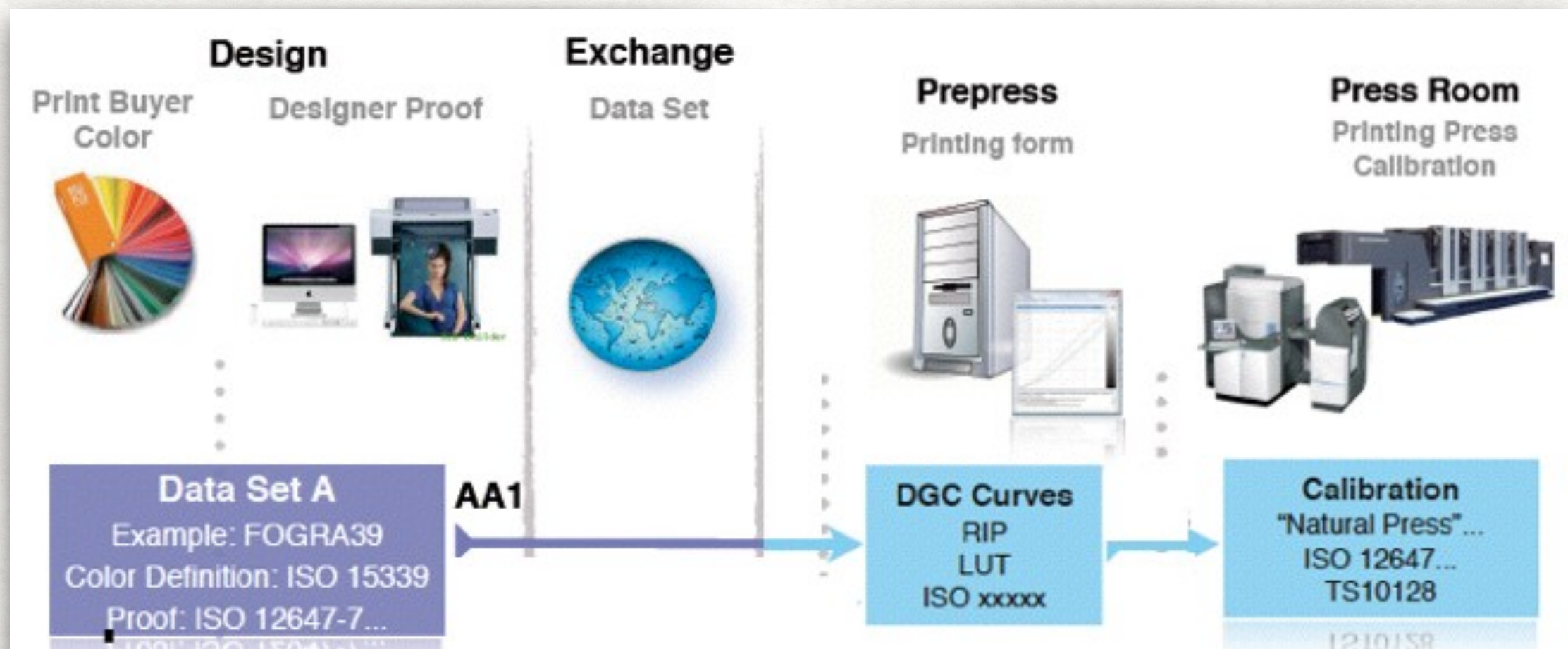
- Aims and tolerances



COMMERCIAL PRINTING

CMYK+SPOT

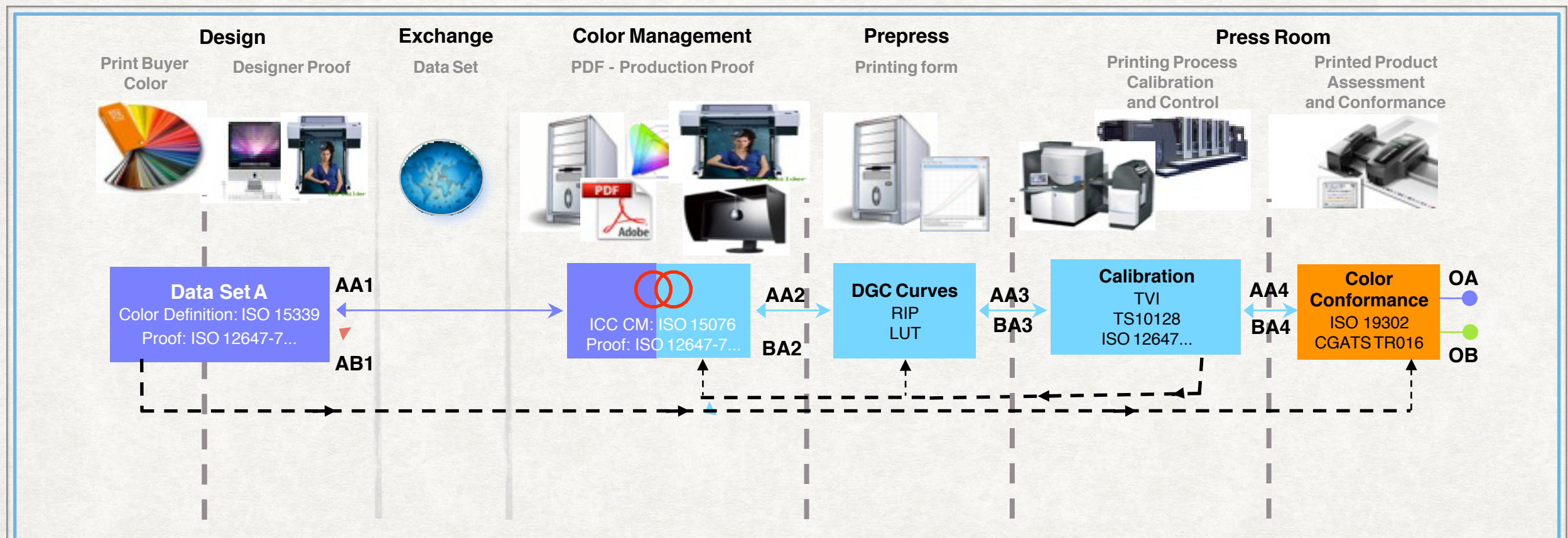
- Aim: **RPC**, spot colors
- Reality: process control with feedback from printed paper, **APC**



PRINTING WITH ACP MATCHING RPC

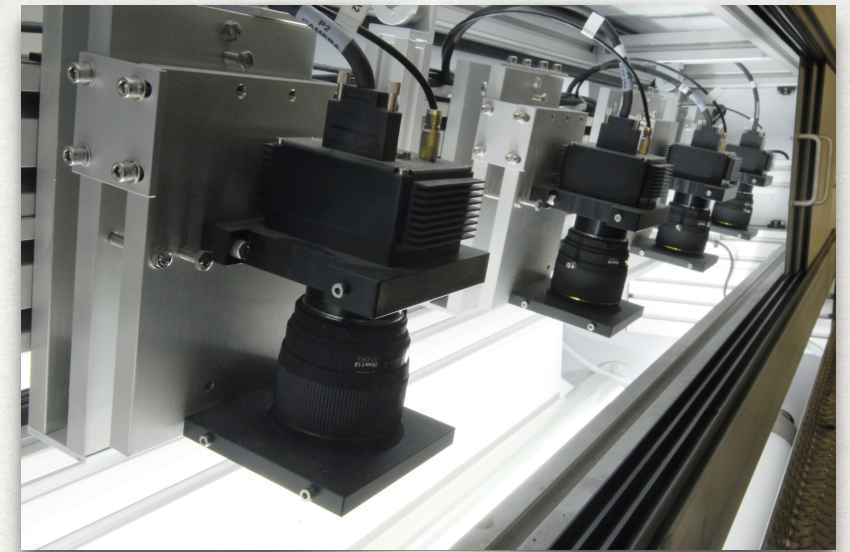
AUTOMATIC PILOT

- CRPCs being chased by APC
- Adjustments in press, CTP curves or DLP in prepress

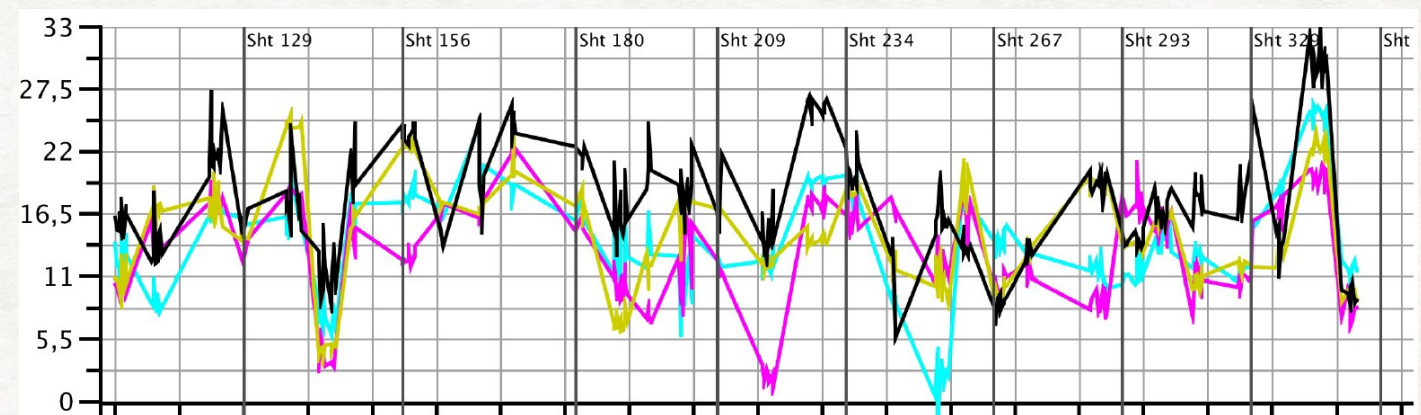


CUSTOMER REQUISITES

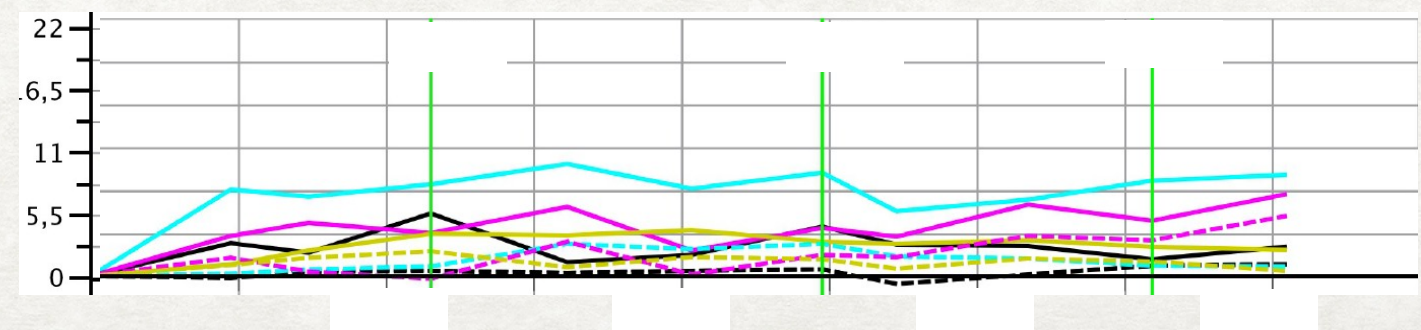
CONTROL OVER PRINTED MATTER



Print stability with
manual process control

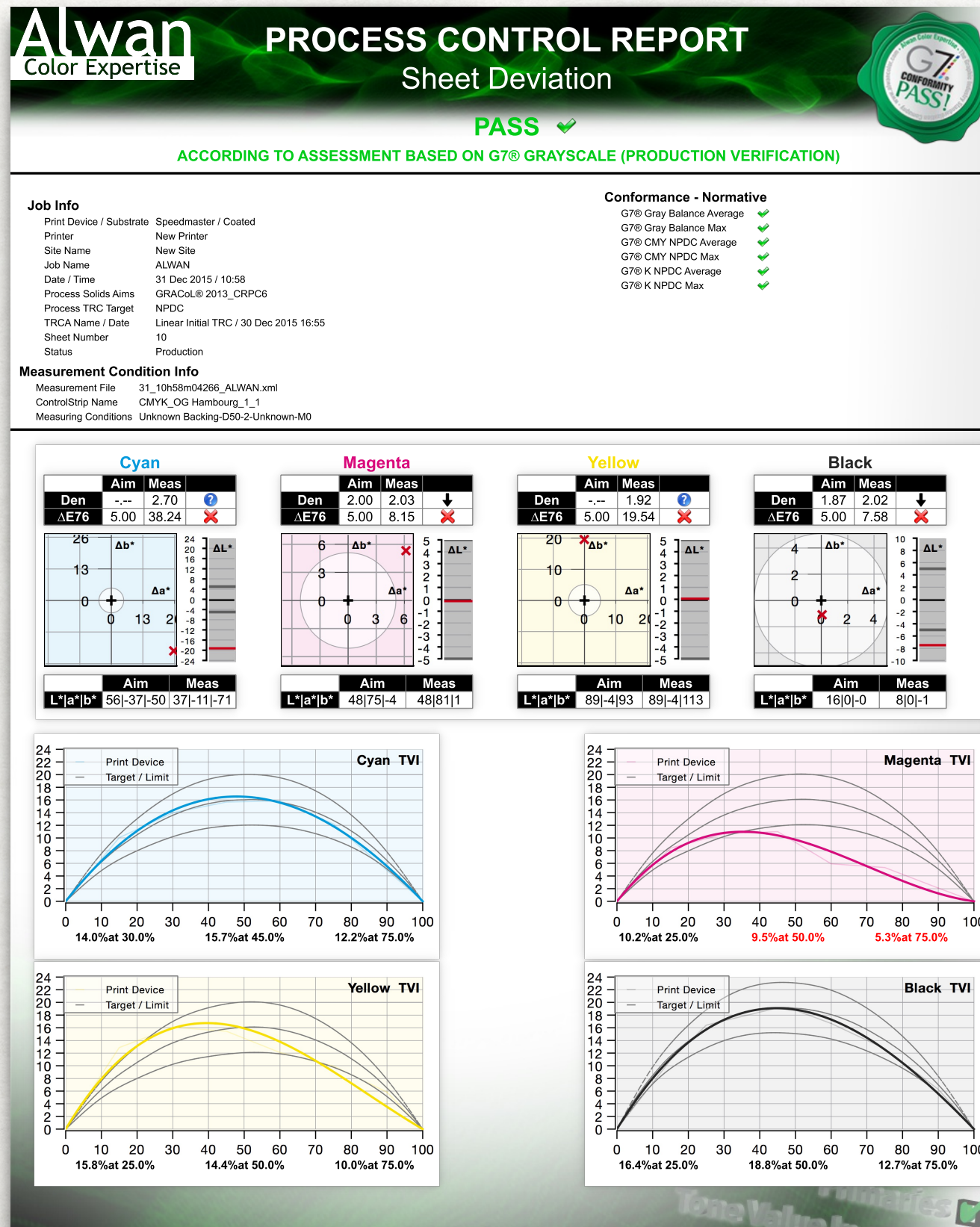


Print stability with in line
process control



REPORT

PROCESS - PROCESS WITH PARTIAL OR FULL TRACEABILITY



REPORT

SPOT - WITH PARTIAL OR FULL TRACEABILITY



COLOR CONTROL REPORT Sheet Deviation



PASS ✓

ACCORDING TO ASSESSMENT BASED ON DEFAULT ASSESSMENT

Job Info

Print Device / Substrate Speedmaster / Coated
Printer New Printer
Site Name New Site
Job Name ALWAN
Date / Time 31 Dec 2015 / 10:58
TRCA Name / Date Linear Initial TRC / 30 Dec 2015 16:55
Sheet Number 10
Status Production

Measurement Condition Info

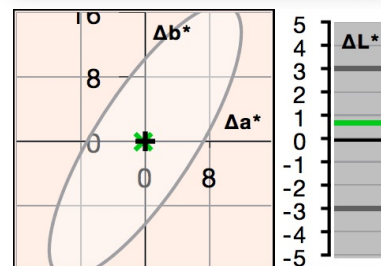
Measurement File 31_10h58m04266_ALWAN.xml
ControlStrip Name CMYK_OG Hambourg_1_1
Measuring Conditions Unknown Backing-D50-2-Unknown-M0

Conformance - Normative

Orange_Spot Solid ΔE Max ✓
Orange_Spot Solid ΔE Avg ✓
Orange_Spot Solid Δh Max ✓
Orange_Spot Highlight/QuarterTone TVI ✓
Orange_Spot MidTone TVI ✓
Orange_Spot Shadow/Three-QuarterTone TVI ✓
Device Red_Premier Solid ΔE Max ✓
Device Red_Premier Solid ΔE Avg ✓
Device Red_Premier Solid Δh Max ✓
Green_Spot Solid ΔE Max ✓
Green_Spot Solid ΔE Avg ✓
Green_Spot Solid Δh Max ✓
Green_Spot Highlight/QuarterTone TVI ✓
Green_Spot MidTone TVI ✓
Green_Spot Shadow/Three-QuarterTone TVI ✓

Orange_Spot

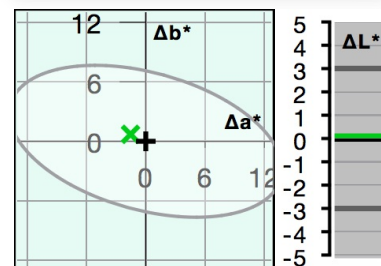
	Aim	Meas	
Den $\lambda 490$	2.21	2.21	✓
$\Delta E00$	3.00	0.58	✓



	Aim	Meas
L* a* b*	62 62 96	63 62 96

Green_Spot

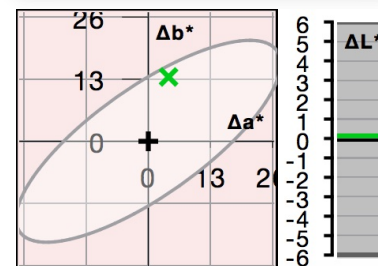
	Aim	Meas	
Den $\lambda 660$	2.24	2.32	↓
$\Delta E00$	3.00	0.40	✓



	Aim	Meas
L* a* b*	74 -73 20	74 -75 21

Device Red_Premier

	Aim	Meas	
Den	---	---	?
$\Delta E00$	6.00	4.68	✓



	Aim	Meas
L* a* b*	47 68 48	47 72 61

THANK YOU

Bruno Mortara

bmortara@usp.br