

Spectral data communication from prepress to press

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29 June 2017

SunChemical[®]

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Color & Comfort

working for you.

What's printing...

Process color – CMYK



Extended Color Gamut – ECG

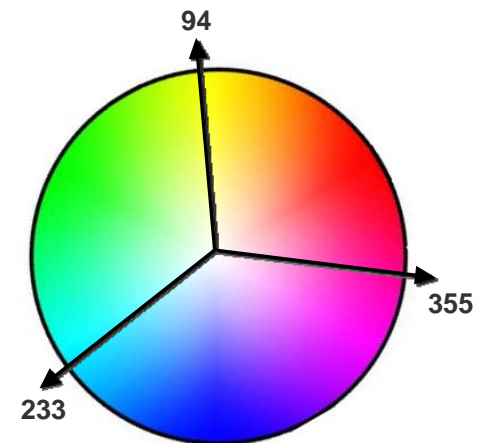


Spot Colors, Pantone or Brand Colors



Color in Process Ink Sets

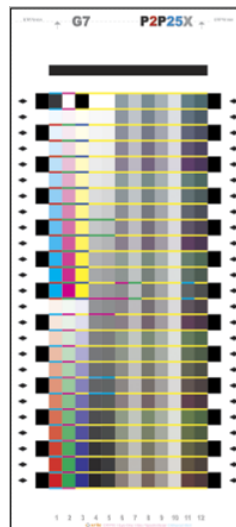
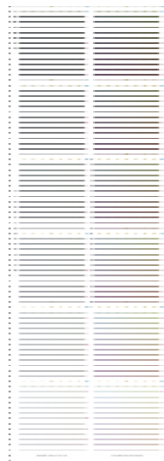
- Process printing – developed in the end of the 19th and beginning of the 20th century
 - The use of “printers” red, blue and yellow primary inks and contact halftone screens to simulate continuous tone colors
 - Typically controlled by densitometry
- Process Color Standards
 - ISO 2846 - Colour and transparency of printing ink sets for four-colour-printing
 - ISO 12647 - Process control for the production of half-tone colour separations, proof and production prints
 - FTA FIRST 5.1 - Flexographic Image Reproduction Specifications & Tolerances
 - Pigment C.I. Codes for process sets
 - Densitometry and Colorimetry recommended values
 - TVI & Dot Gain



Densitometry vs. Colorimetry

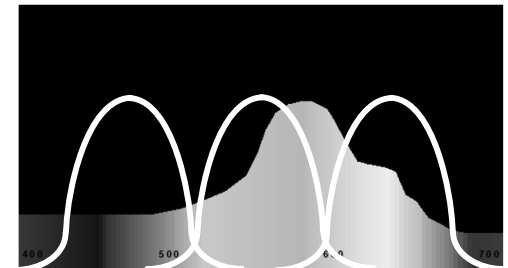
GRACoL 7 and G7 Methodology

- TVI curves, as in Fogra and SWOP standards, are based on densitometry, which has no fixed relationship to colorimetry.
- GRACoL 7 and G7 eliminates the TVI problem by replacing multiple TVI curves with the spectrally based 'NPDC' (Neutral Print Density Curve).
- G7 methodology provides method to colorimetrically match the NPDC and gray balance of neutral gray tones on different devices.



Densitometers vs. Spectrophotometer

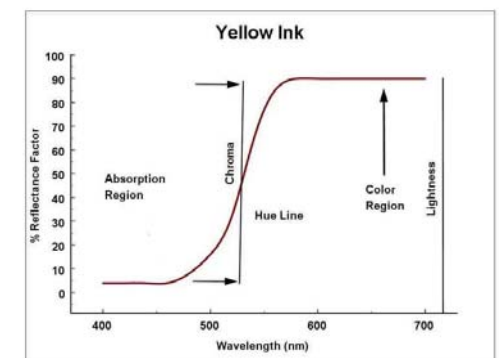
- Developed as a quantitative measurement of optical density in light-sensitive materials, such as photographic paper or photographic film.
 - Density comes from absorption
 - Color comes from non-absorption



- A Densitometer measures the amount of the ink on a substrate. It sees “B&W”, lightness and darkness, but not color.



- A Spectrophotometer can “see” the wavelength and frequency of light. It is the most accurate graphics color measurement equipment.
 - Visual attributions arise from transitions of the curve



Extended Color Gamut Ink Sets

- Extended gamut printing is a method of expanding the color gamut beyond what can be replicated using conventional 4-color process printing.
- Typical ECG ink set combination includes CMYK + OGV
- Some special brands may include Red or Blue inks, e.g. Coke, Lufthansa.
- ECG reduces the need for custom spot colors and the press can run the same colors on every job.



conventional process ink set



extended color gamut ink set

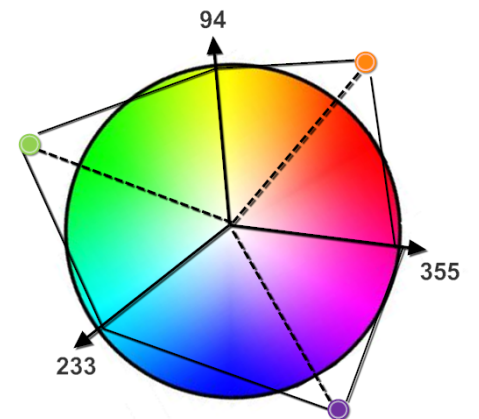
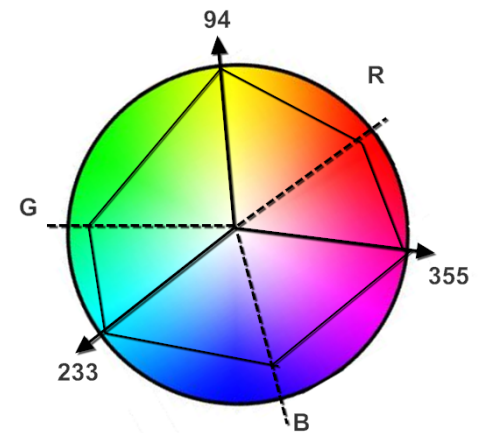
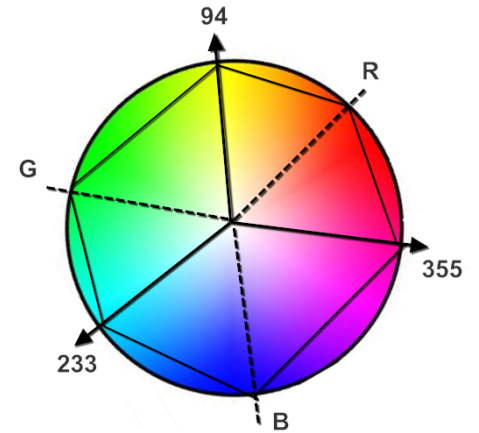


ECG Process Ink Set

- Concerns with standard process ink mixing:
 - Ink trapping reduces the film thickness of 2nd down ink and lowers the Chroma
 - Transparency of 2nd down ink produces shifts in hue of 2-color overprints
- Replace overprinted primary with a pure primary
 - Pure primary can have much greater Chroma
- Overprints of primaries achieve new colors
 - Pure primary may have better transparency
- Six color halftones make more realistic images
 - More primaries may decrease metamerism

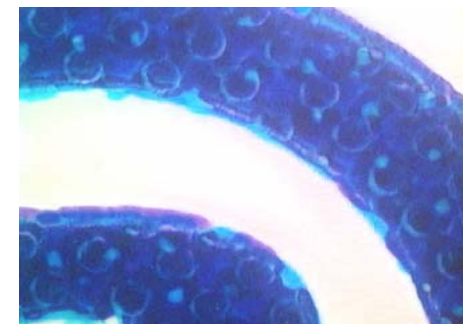
FTA recommends

- Orange at 54°
- Green at 181°
- Violet at 307°



Limitations of ECG Process Ink Set

- Many PMS colors still fall outside of even a 7 color gamut
 - Reduced ink consumption minimal
 - Increased prepress & design times
 - Press downtime reduced with better efficiency
- Process printing is more difficult to control than line printing
 - Spot color tolerances are in the range of 1 – 2 DE units
 - Process color tolerances are in the range of 4 – 5 DE units
 - Spot color inks do not have to be as transparent since not used in overprinting
- ISO 21328 Standard ink set for multicolor printing confirming findings of the FTA/Clemson initiatives on most suitable hue angles for the extra inks; Pantone ECG Guide created accordingly

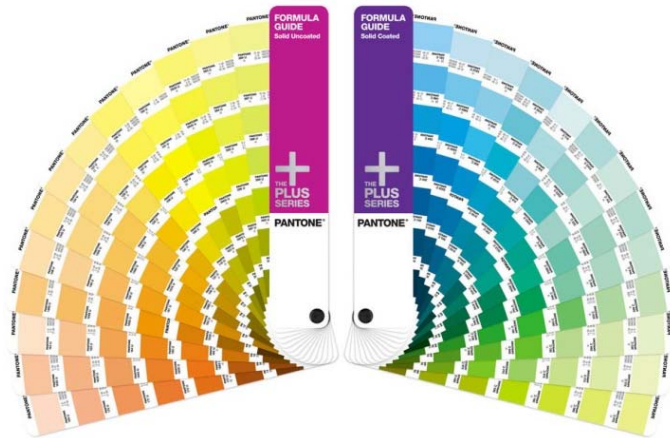


Zoom of Pantone® PMS 287 printed 150 line screen, built of cyan, violet and green



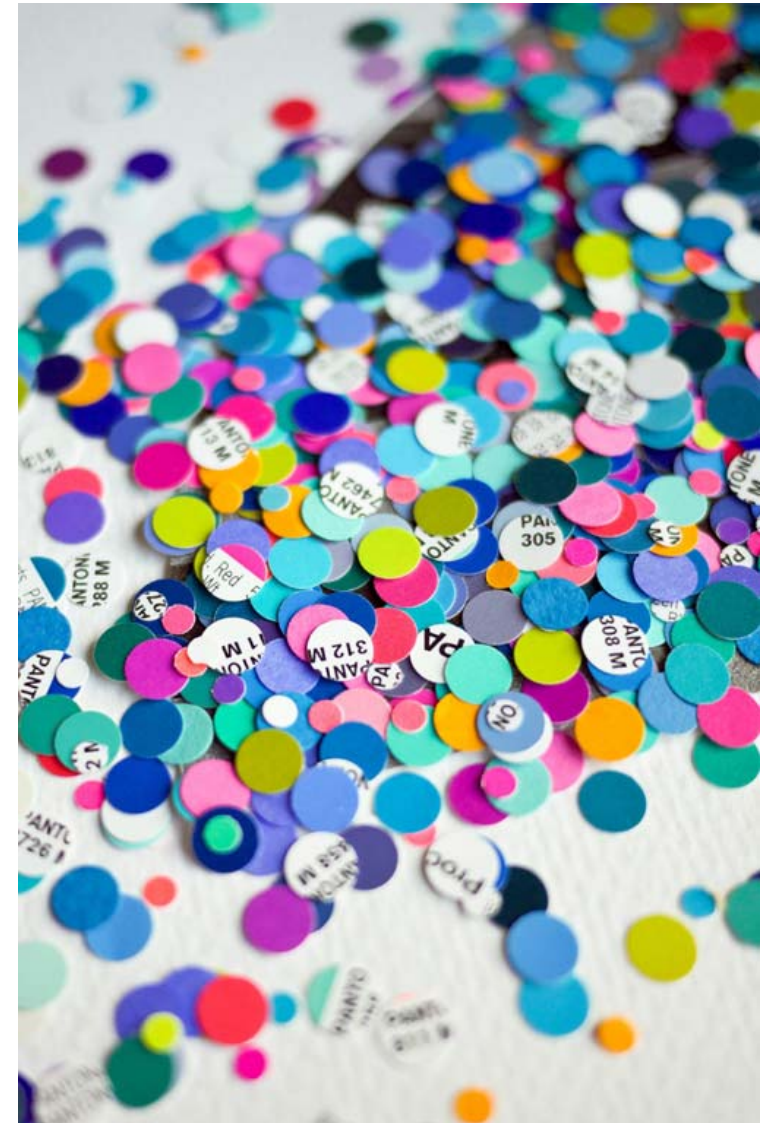
Spot and Brand Color Inks

- Color Guides
 - X-Rite/Pantone, DIC, Toyo, Flint,

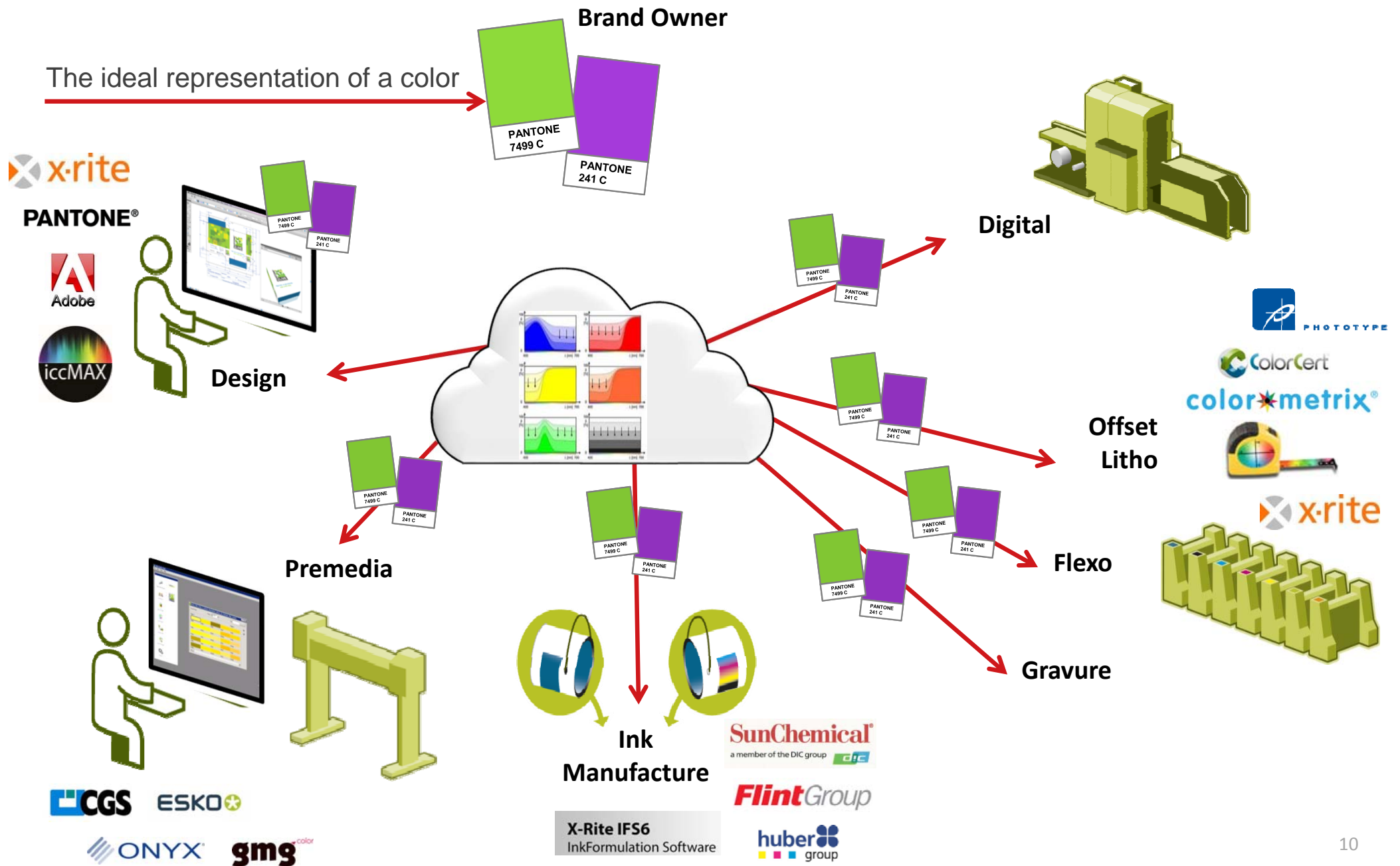


- Brand Owners Color Guides
 - P&G, Sara Lee, Mars

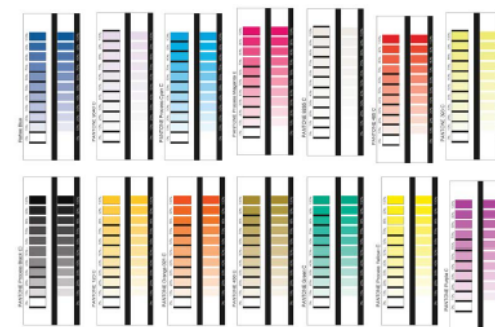
- Special Application Color Guides
 - Textile, Metallic, Pearlescent



Spectral Data - Communication Tools



Spot Color Tonal Value Communication



- ISO 20654 standard implementing SCTV Metric based on spectral reflectance data
 - ISO 20654 Graphic technology -- Measurement and calculation of spot colour tone value (International Standard under publication)
- Test charts were printed using a number of printing processes
- 10 different methods of estimation of intermediate tones were evaluated and SCTV was selected as the solution with the best result overall without being too complex to implement
- CxF/X-4 provides a mechanism to communicate measurement data for solid and intermediate tones

ISO 17972-4 CxF/X-4 Graphic technology -- Colour data exchange format (CxF/X) -- Part 4: Spot colour characterisation data (CxF/X-4)



ICC Capabilities for spectral communication

- iccMAX Named Color Profiles can provide ways for spot color communications through the spectral PCS for different viewing conditions, surface characteristics, different rendering intents.
 - NamedColorArray
 - Tint values (tin0 value for substrate)
 - Spectral information
 - Overprint calculations
 - etc
- iccMAX, metadata, metadataAccess
 - Associated with accessing either direct encoding of tag data or a representation of the tag data outside of context of transform processing by the CMM.
 - Enabled when tags are present in a profile.
 - Examples: colorant order and information, spectral color measurement data, gamut visualization, calibration information, etc.



Digital Color Communication



- Brand owners sending color requests based on the digital files that can contain spectral reflectance information of the color
- Examples of these are CxF files, MIF files, TXT files, QTX files, Pantone or PantoneLIVE references to digital libraries
- These can be uploaded to the Ink Formulation System for the proper ink formulation process
- Spectral information is necessary for achieving the closest non-metameric match to the requested color on the press

```
Walmart Magenta.CXF - Notepad
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<CxF version="1.0">
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  <Created>2006-10-02/14:39:07</Created>
  <Modified>2006-10-02/14:39:07</Modified>
  <SampleSet>
    <Name>walmart ISO 12647-2 Mif only</Name>
    <Created>2006-10-02/14:39:08</Created>
    <Modified>2006-10-02/14:39:08</Modified>
    <Sample>
      <Name>Magenta</Name>
      <Created>2006-10-02/12:38:41</Created>
      <Modified>2006-10-02/14:39:08</Modified>
      <AdditionalData>
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    </Sample>
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</CxF>
```

Spot color mixing based on spectral reflectance data

Assortment: Sonoco - 0345 Bases - surface print on white film

Recipe: 1: PANTONE 205 C PASS

<input type="checkbox"/> DPT-273 Vehicle	-> 17.19
<input checked="" type="checkbox"/> 26205-0311 - XP Permanent Yellow - Base	-> 4.26
<input checked="" type="checkbox"/> 46150-0345 - Rubine - Base	-> 18.00
<input checked="" type="checkbox"/> 4664-0345 - Quanacridone - Base	-> 46.49
<hr/>	
Total basic ink:	85.95
80/20 NPA/NPac	-> 14.05
<hr/>	
Total:	100.00

PANTONE 205 C (1/50)
- [] X

Display: Reflectance spectra

Target color: - -

Recipe: - -

Target color (M0 (No))

L* = 55.2

C* = 66.3

h = 3.7

[D50, 2°]

Recipe: calculated

dL* = -0.1

dC* = 0.4

dH* = -0.2

Surf White PE

dE₀₀: 0.2

M1 [A]: 0.4

M2 [FL2/CWF]: 1.3

Price: 0.00 \$

Spot Color Quality Control – Past & Present & Future

- Color quality control started visually in the past, making it hard to agree among the “judges”



- Currently majority of color evaluations are done by color swatches and color data, e.g. R%, CIELAB, DE, but still checked visually




```
<?xml version="1.0" encoding="UTF-8"?>
<CXF version="1.0">
  <Name>WalMart ISO 12647-2 Mif Only</Name>
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    <Sample>
      <Name>Magenta</Name>
      <Created>2006-10-02/12:38:41</Created>
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      <AdditionalData>
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          <value Name="400">0.1775</value>
        </spectrum>
      </SampleAttribute>
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  </Sampleset>
</CXF>
```

- Newest trends are based purely on the digital files that contain reflectance information and desired DE tolerances



PANTONE Digital Library vs Book Readings – Warning!

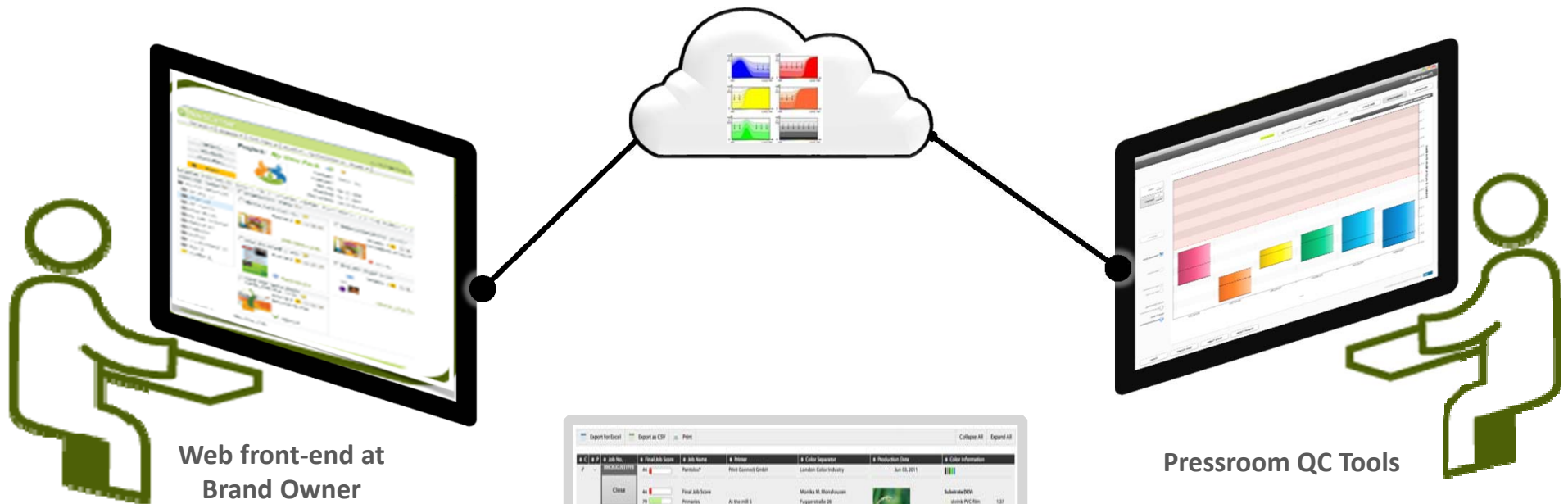
- There are known and documented differences between digital files and actual Pantone PLUS Series formula guides.
(The Pantone PLUS Series guides state that the printed versions are just guides for ink formulations under specific conditions.)
- Concerns:
 - If visual assessment is part of QC follow the book, not digital data
 - The PMS swatch can be measured into the QC software in as a Standard and batches checked against it
 - If matches to digital file are requested, only match to numbers should be done (DE, DC, Dh)



PANTONE 461 C Spl FAIL dL* = 0.50 da* = -1.56 db* = 20.29 dC* = 20.34 dH* = -0.29 dE2000= 6.91	PANTONE 460 C Spl FAIL dL* = 1.50 da* = 0.90 db* = 17.46 dC* = 17.39 dH* = -1.83 dE2000= 5.52	PANTONE 459 C Spl FAIL dL* = 1.49 da* = 1.24 db* = 12.45 dC* = 12.40 dH* = -1.70 dE2000= 3.74	PANTONE 457 C Spl FAIL dL* = 2.95 da* = 2.61 db* = 17.59 dC* = 17.69 dH* = -1.85 dE2000= 4.89	PANTONE 461 U Spl FAIL dL* = 0.55 da* = -2.87 db* = 24.18 dC* = 24.32 dH* = 1.15 dE2000= 8.31
PANTONE 509 C Spl FAIL dL* = 1.32 da* = 2.53 db* = 4.50 dC* = 2.23 dH* = 4.66 dE2000= 3.32	PANTONE 340 C Spl FAIL dL* = 0.65 da* = -2.31 db* = 1.74 dC* = 2.62 dH* = -1.22 dE2000= 1.07	PANTONE Reflex Blue C Spl FAIL dL* = -1.45 da* = -4.42 db* = 5.14 dC* = -6.55 dH* = -1.78 dE2000= 1.68	PANTONE Blue 072 C Spl FAIL dL* = -2.12 da* = -0.03 db* = 0.18 dC* = -0.17 dH* = 0.07 dE2000= 1.41	PANTONE 485 C Spl PASS dL* = -0.32 da* = 0.42 db* = 0.43 dC* = 0.59 dH* = 0.08 dE2000= 0.34

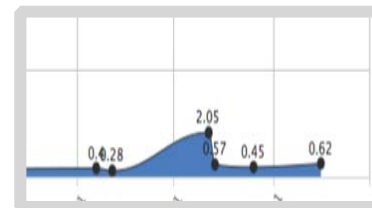
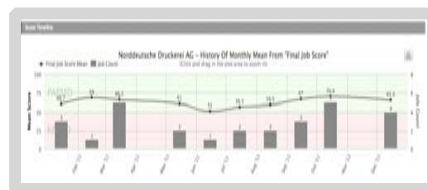
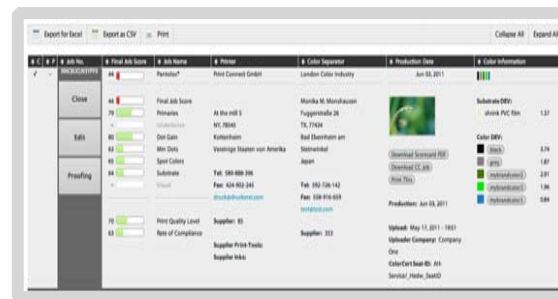
Closing the Loop on Color Communications

- Closed loop feedback (reporting real-time press results)
- A robust system of spectral color communication from the front-end of the design cycle, through the entire supply chain.



Web front-end at Brand Owner

Pressroom QC Tools



Possibilities with spectral data and cloud based communication

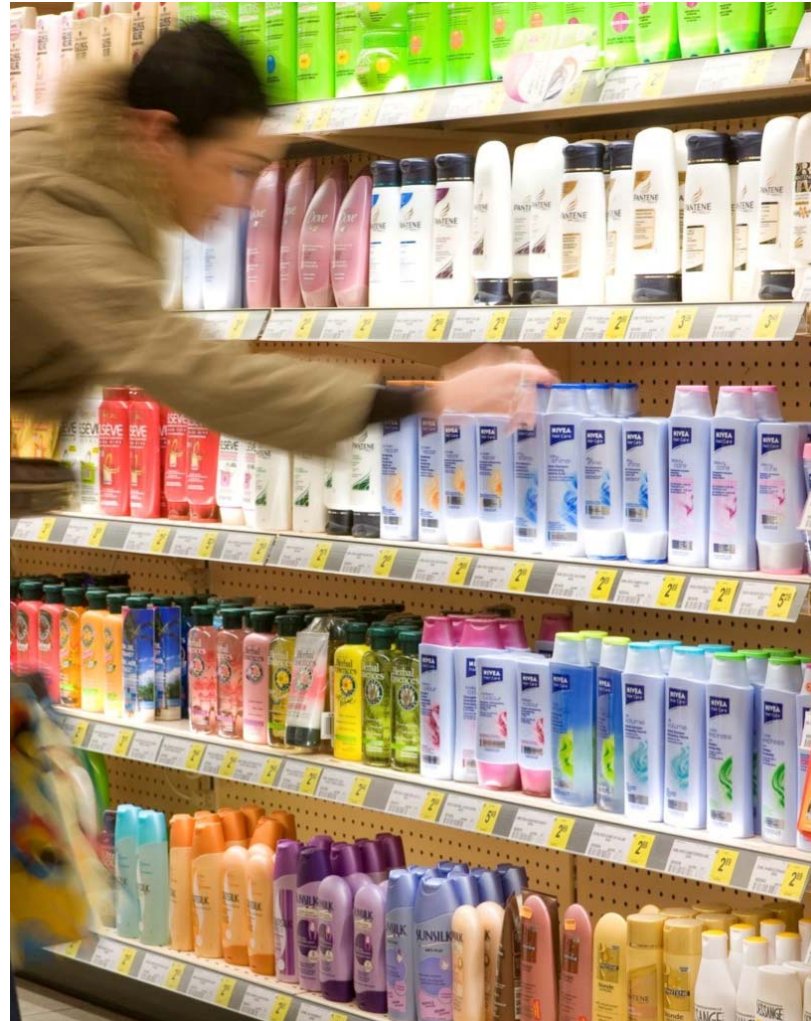
BEFORE



AFTER



THANK YOU!



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