

What Can You Really Expect from a Color Match Between Processes?

Jan Lemieux

Manager, Pre-Sales Solutions Support
Canon Solutions America

Steve Upton

President
CHROMiX



Challenges to a match

- Colorant / media differences and interactions
- Technology to apply colorant to media
 - How different processes vary and the impact this has
- Gamut
- Numbers vs. Appearance
 - Spot Color Match on Gamut Challenged Processes
 - SCCA
 - Black Point problems (uncoated press sheet)
- Customer expectations
 - Sometimes starts with the expectation of a perfect match



Colorants



Offset ink is an **oil, soy** or **rubber-based** ink used in offset printing. It's formulated to resist other chemicals it comes in contact within the printing process. It is crucial that offset ink resist water-in-ink **emulsification** (e.g., repel rather than absorb water). Offset ink has **rich pigments** giving full color vibrancy.



Toner is a **powder** used in laser printers and photocopiers to form the printed text and images on the paper, in general with a toner cartridge. In its early form it was a mix of carbon powder and iron oxide. Then, to improve the quality of the printout, the carbon was melt-mixed with a polymer.



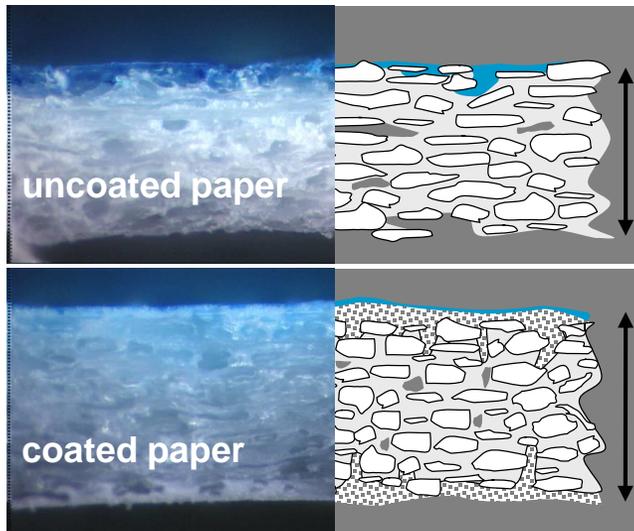
Aqueous Inkjet printers, as used in offices or at home, tend to use **aqueous** (water based) inks based on a mixture of **water, glycol** and **dyes** or **pigments**.



Interactions

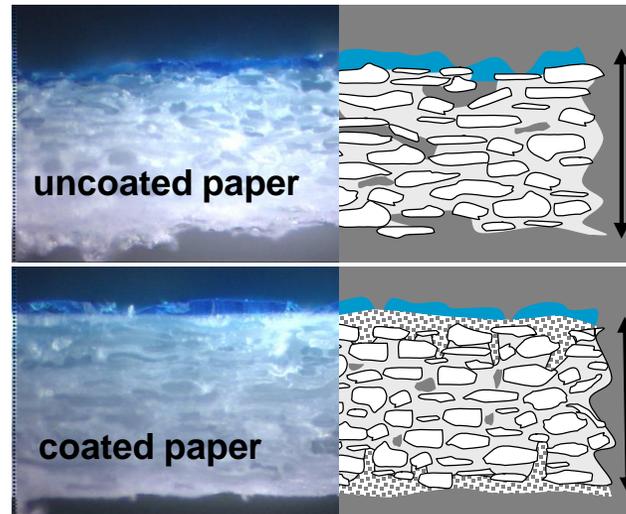
Offset

- thin layer of ink visible on the paper, some ink penetration into uncoated paper



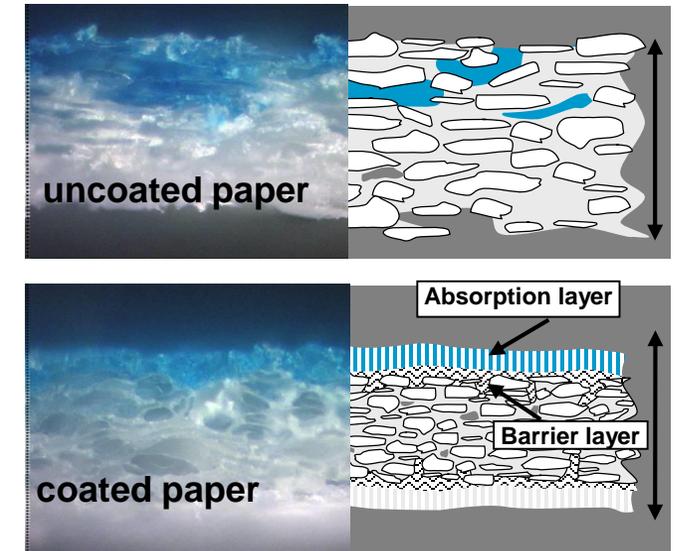
Dry toner

- thick layer of toner is visible on top of the paper



Aqueous Inkjet

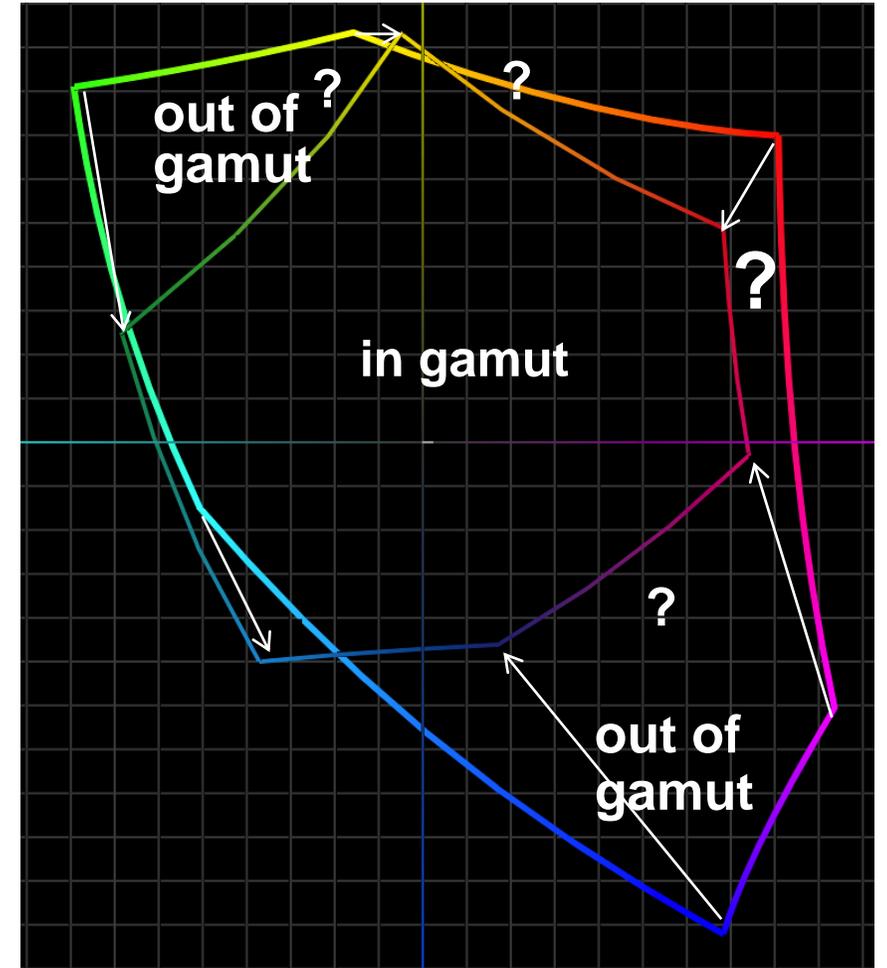
- A strong penetration of ink in the paper, no closed layer on top of the substrate



Microscopic photographs of Cyan Solid Tone on Coated & Uncoated Paper



Gamut



Numbers vs. Appearance

- What is a match?
 - Same media, ink, target, press
 - Numeric vs Visual
 - Time and Cost to achieve lowest numeric value
- Shared Appearance
 - Do numbers matter?
 - We're not selling color bars and crop marks.
 - How to create numbers that are useful.
- Shared Appearance can set expectation of comingled technology and ability to make output look similar.



Spot Color Challenge



RGB



HTML



CMYK



Uncoated media



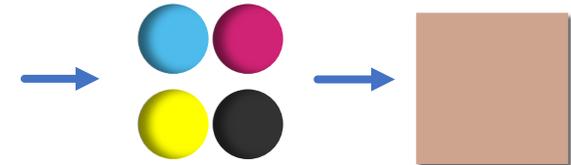
Coated media



Definition's change pending color space or media



PANTONE Orange 021 U

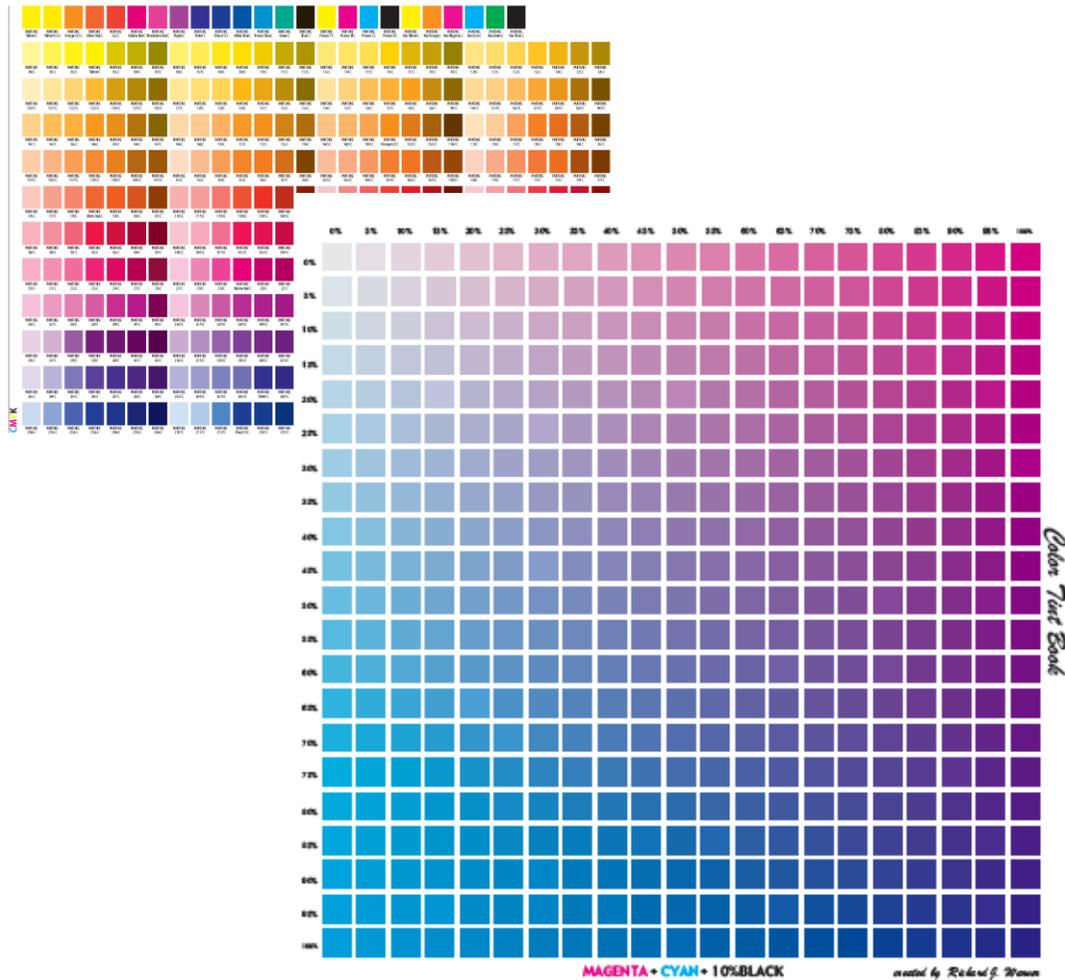


PANTONE Orange 021 U

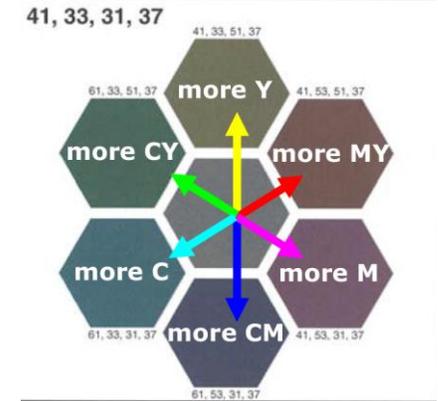
PANTONE®	
Solid	CMYK
PANTONE 1767 C	PANTONE 1767 PC
R 250 G 177 B 194	C M Y K
HTML FAB1C2	0 32 10 0



Numbers vs. Appearance “Tint Book”



- Reference chart that matches the printing conditions



- Look-up table

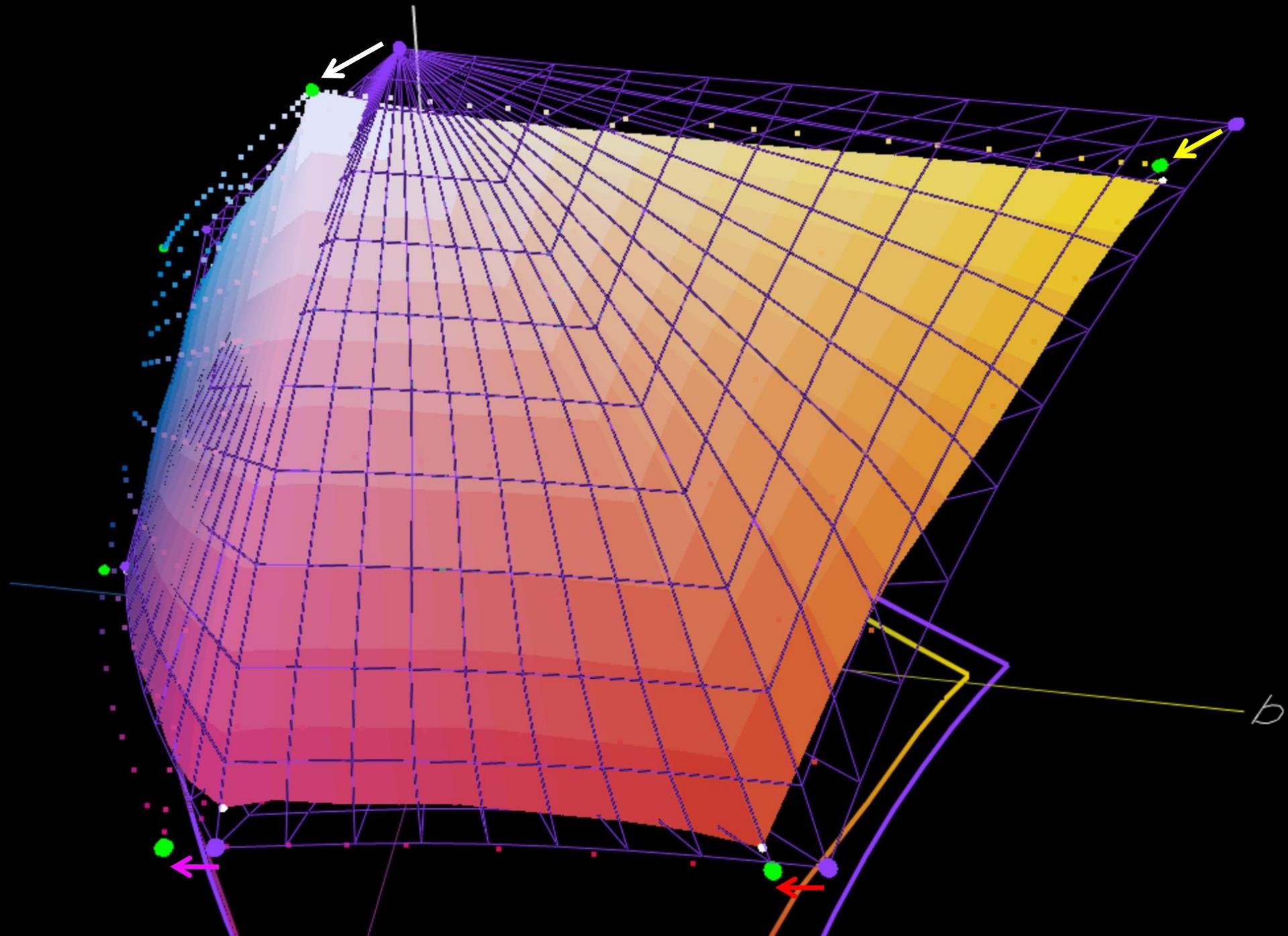
- W.Y.S.I.W.Y.G.



SCCA – helping the numbers

- Substrate-Corrected Color Aim modifies the *color aim* to match the white point of the sample
- **Very** useful for when your substrate doesn't match a CRPC (often)
- BUT beware the edges of the leaning tent (unexpected changes in primaries and secondaries)

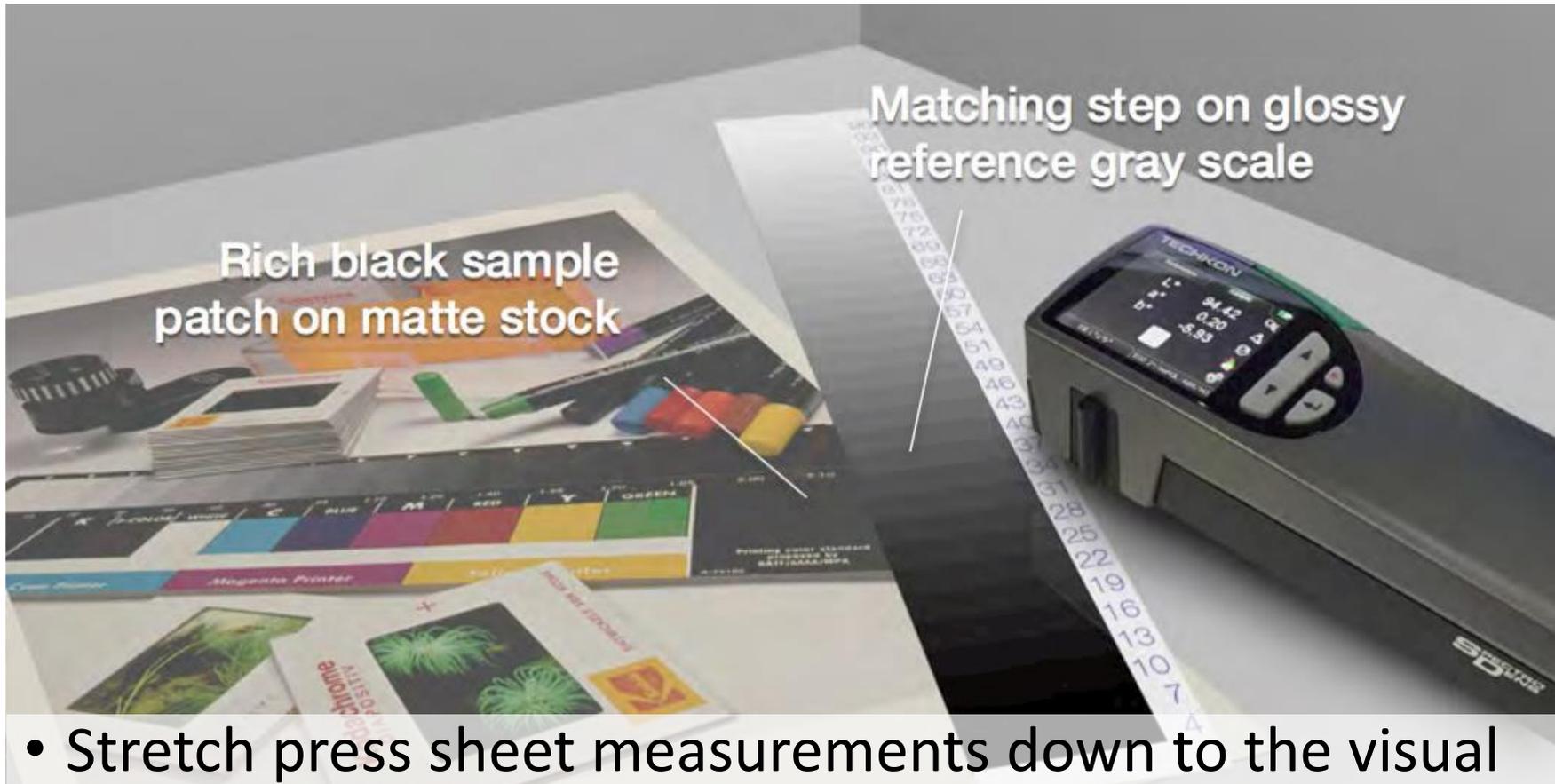




Black Point Problem



Black Point Solution



- Stretch press sheet measurements down to the visual L* of a comparable glossy print



Customer expectations

- Define acceptable and insure it aligns with possible.

$\Delta E00$	Perceived Color Difference
< 1	Perfect match, nearly impossible to see any difference
1 - 2	Tiny difference, excellent match, acceptable to even demanding customers
2 - 3	Small difference, only noticeable to the most demanding customers
3 - 4	Medium difference, generally acceptable to average customers
4 - 5	Standard color drift in printing (ISO offset tolerance) customer may not like but will approval usage (IE: business cards)
5 - 8	Large difference, generally not acceptable, most customer will notice and might complain, but should accept if price or service is superior
> 8	Major difference, customers will question output and might refuse to accept



Customer expectations

- Biggest issues tend to be viewing conditions and brand color references
- Challenge assumptions (including your own)
 - *“Nothing is more confusing than a confused customer.”*
- Delta-E, Instruments and the Numeric Match
 - The relentless pursuit of ΔE below 1
 - Instrument differences can be up to 30% of your “error budget”
- Patches, Metrics and scoring systems
 - 95th Percentile can be a good indicator, but it is highly dependent on the other patches in the target
 - Scoring systems (metric weighting) can sweep problems under a numeric rug



Solid Foundation

- G7 the great normalizer
 - Industry agreed common aim
 - Repeatable method
 - Shared appearance
- "True" G7 calibration vs 'just use profiles'
 - True Calibration:
 - High valuable when system is less stable
 - Achieving G7 via internal calibration
 - G7 is achievable, all the way to ColorSpace.



Lessons Learned

- What has it taught us
 - Expectations - which differences you can't control
- When does this process fail?
 - Trying to use new tech like you have used old tech - the unlearning
 - Not believing G7 curves when they will work (and knowing the difference)
 - Over-calibration in the higher densities
 - Can screw up saturated brand colors and ramps
 - Try to correct via profiles, making life tougher instead of easier
 - Solutions:
 - Neutralize your CMY patch
 - Taper off the gray balance and use lots of GCR (carefully)
 - Taper into ISO curves in the higher densities



What we can really expect.

- Consolidated Print is possible with achievable expectations
- Implementation of G7 and sound color management principals across a widening array of manufacturing processes makes this possible.
- It's a process not a press.
- Customer expectation still must be managed.

