Consistent Colour Appearance

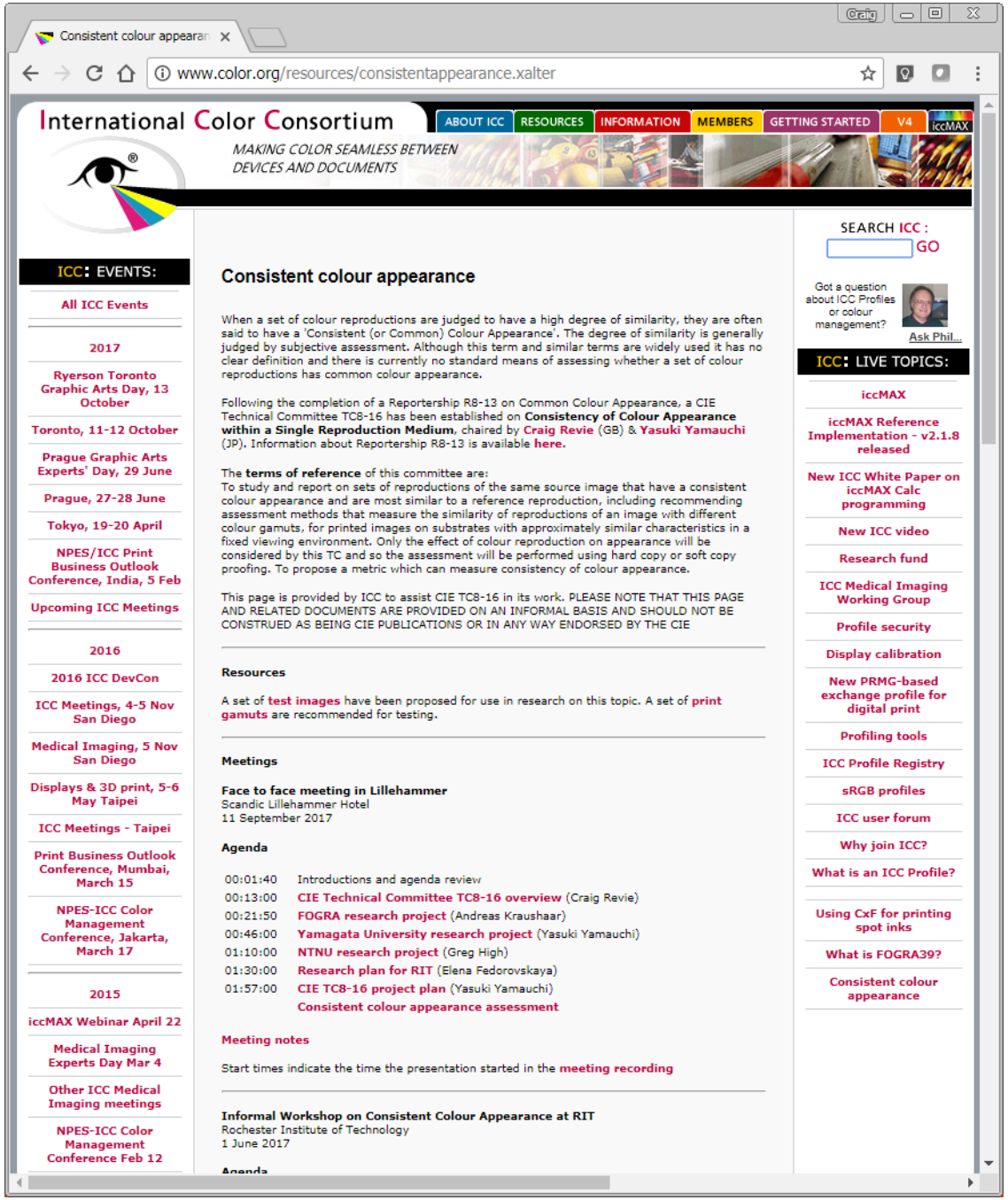
ICC Toronto Graphic Arts Day

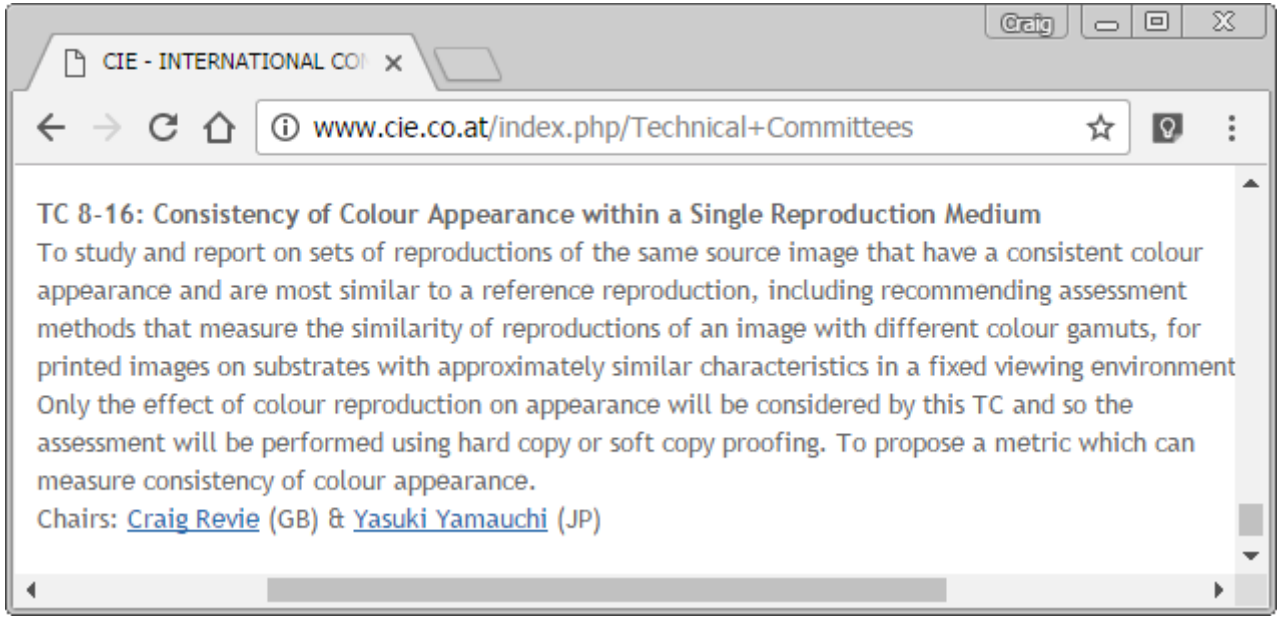
13th October 2017

W Craig Revie, Fujifilm

CIE TC8-16 chair

CIE TC8-16
Consistency of colour appearance within a single reproduction medium





http://www.cie.co.at/index.php/Technical+Committees

http://www.color.org/resources/commonappearance.xalter

CIE TC 8-16 members

Marc Mahy	BE
Claas Bickeboeller	CH
Muhammad Safdar	CN
Yuan Jiang Ping	CN
Andy Kraushaar	DE
Jürgen Seitz	DE
Nikolaus Pfeiffer	DE
Philipp Tröster	DE
Christine Fernandez-Maloigne	FR
Yasuki Yamauchi (chair)	JP
Peter Nussbaum	NO
Phil Green	NO
Chris Bai	TW
Craig Revie (chair)	UK
Gregory High	UK
Jan Morovic	UK
Ronnier Luo	UK
Danny Rich	US
David Hunter	US
David McDowell	US
Don Hutcheson	US
Elena A. Fedorovskaya	US
Max Derhak	US
Michael Brill	US
Po-Chieh Hung	US
Robert Chung	US
Susan Farnand	US
Timothy Baechle	US

28 members, 10 countries, 4 research groups

Overview

A

- Why do the reproductions in set A have similar appearance whereas the reproductions in set B do not?
- Is the degree of similarity of a set of reproductions something that could be measured?

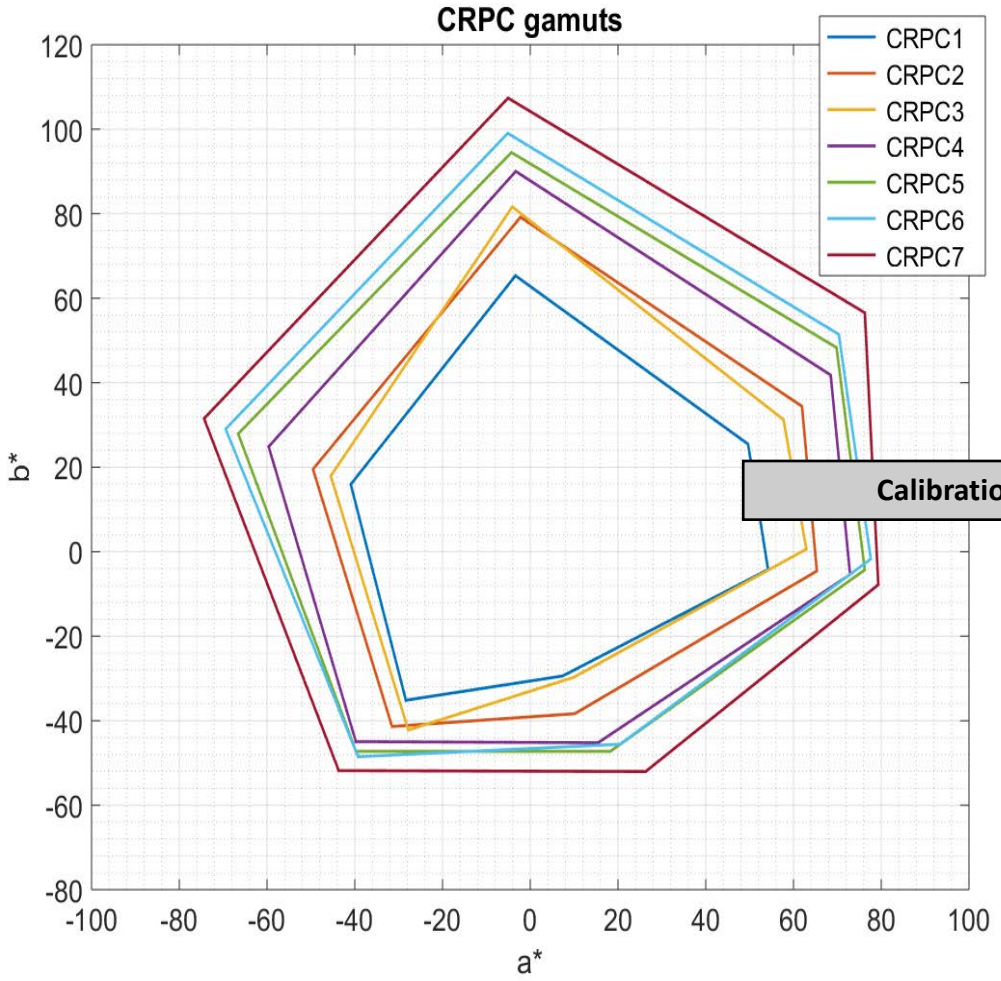
B

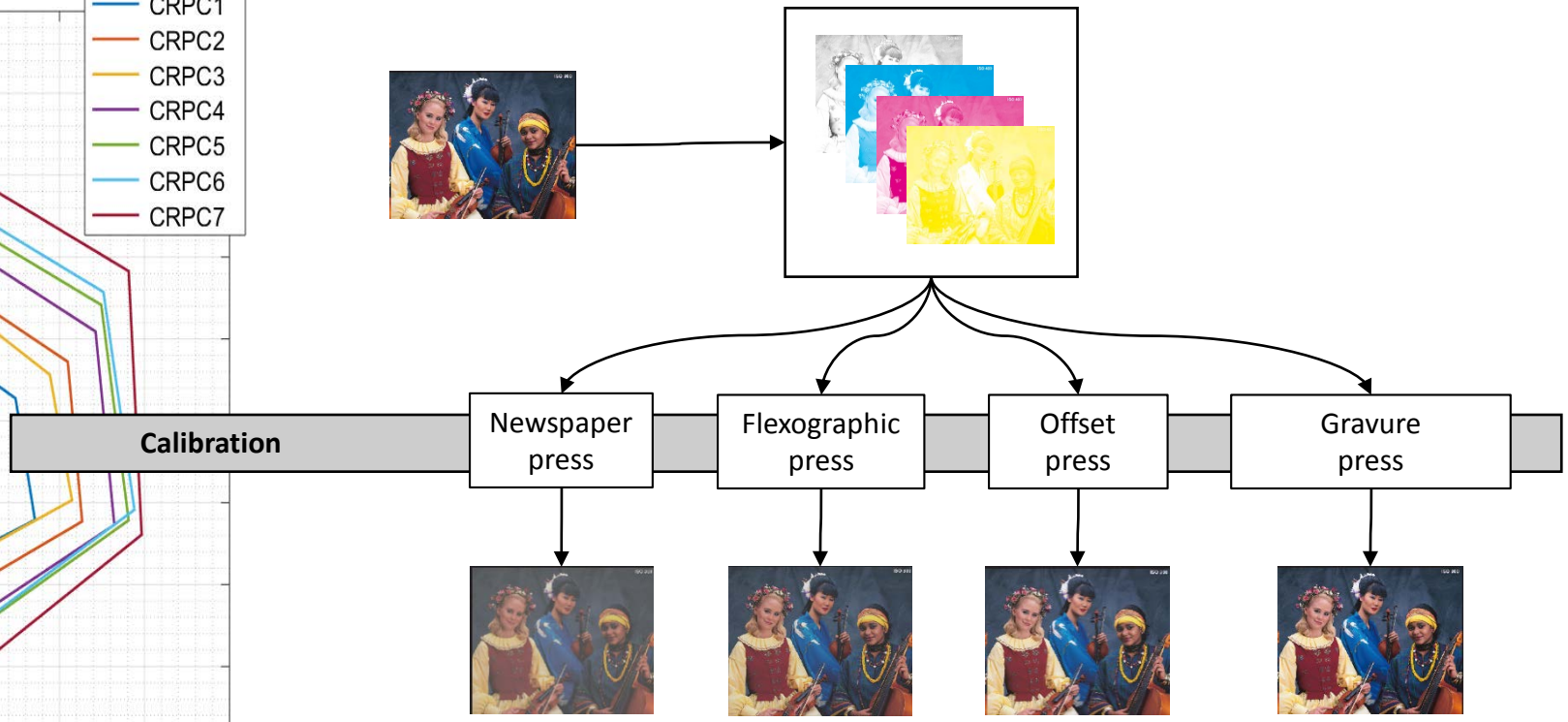
Some questions that currently have no answers:

- Do all observers agree that a set of reproductions have consistent colour appearance?
- Given a set of printing systems is there a single set of reproductions that observers agree are the most consistent set?
- Does consistent colour appearance depend on image content?
- Are there regional or cultural differences that influence this choice?

Why would such a metric be useful?

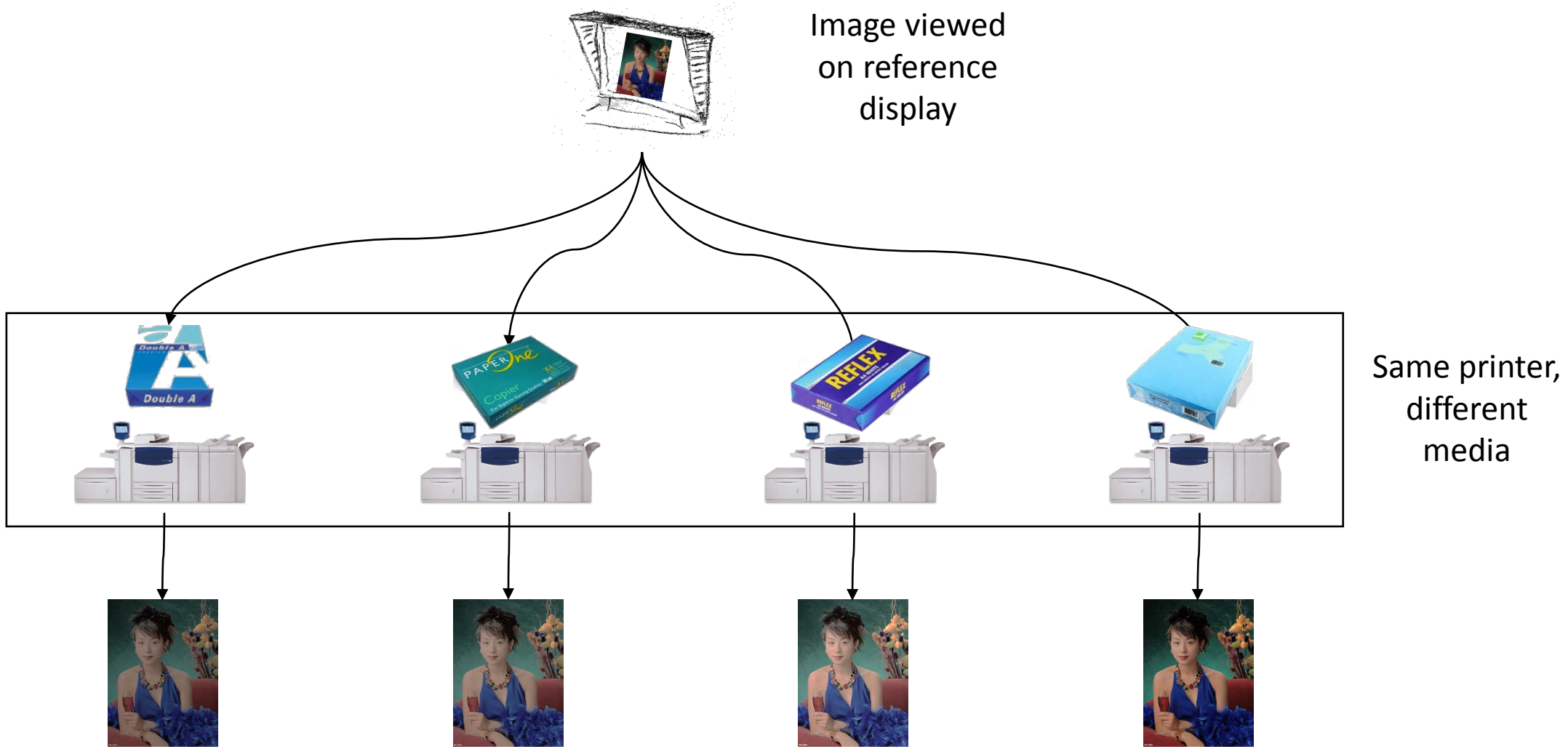
Characterised Reference Printing Conditions (ISO/PAS 15339)





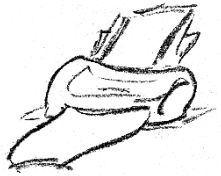
Consistent colour appearance?

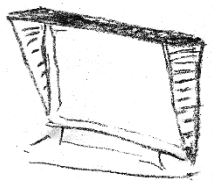
Consistency across different print media



Consistent colour appearance between prints and with display image?

Flexible print (RGB) workflow

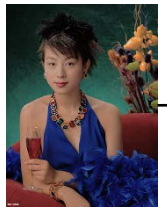




Print contract is agreed based on a ***reference display image*** or ***reference print*** from a standard digital printing system

RGB

Printing should use all of the available printing gamut but must retain colour appearance of agreed reference



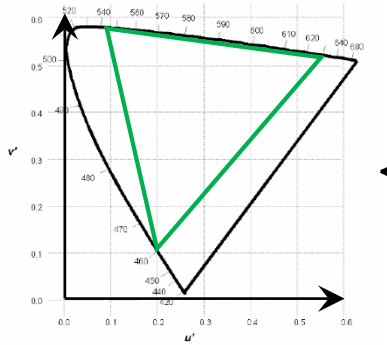
RGB

Colour conversion

Consistent colour appearance?

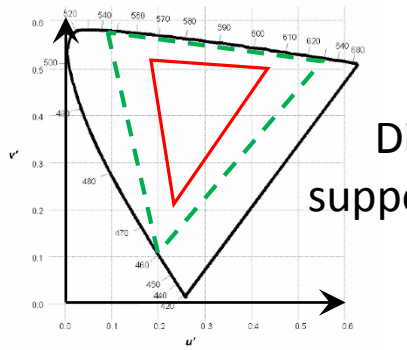
Initial target for CIE TC8-16

Consistency across displays (UHDTV)

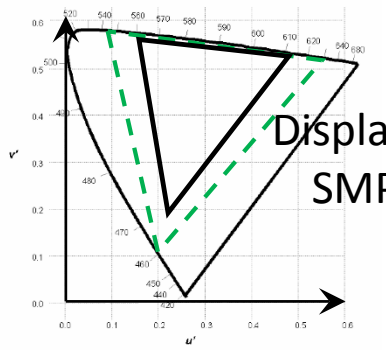


Transmitter uses BT.2020 encoding with very large colour gamut

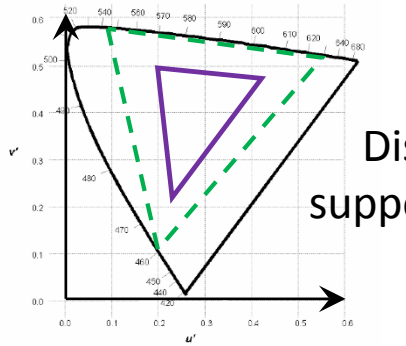
What is needed to achieve consistent colour appearance?



Display A supports BT.709



Display B supports SMPTE DCI-P3



Display C supports sRGB

Brand management

Product packaging

Magazine advert

Newspaper advert

Billboard advert

Vehicle wrap

Television / internet

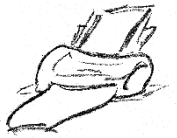
Assessment method (…on a single reproduction medium)

Objective: CCA of printed images

Reference Images

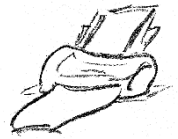
Reference Printer

Includes media, inks and printer configuration



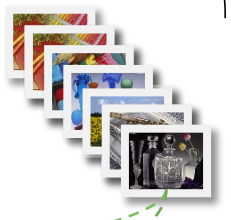
Production Printers

Includes media, inks and printer configuration



Production Prints

Reference Prints



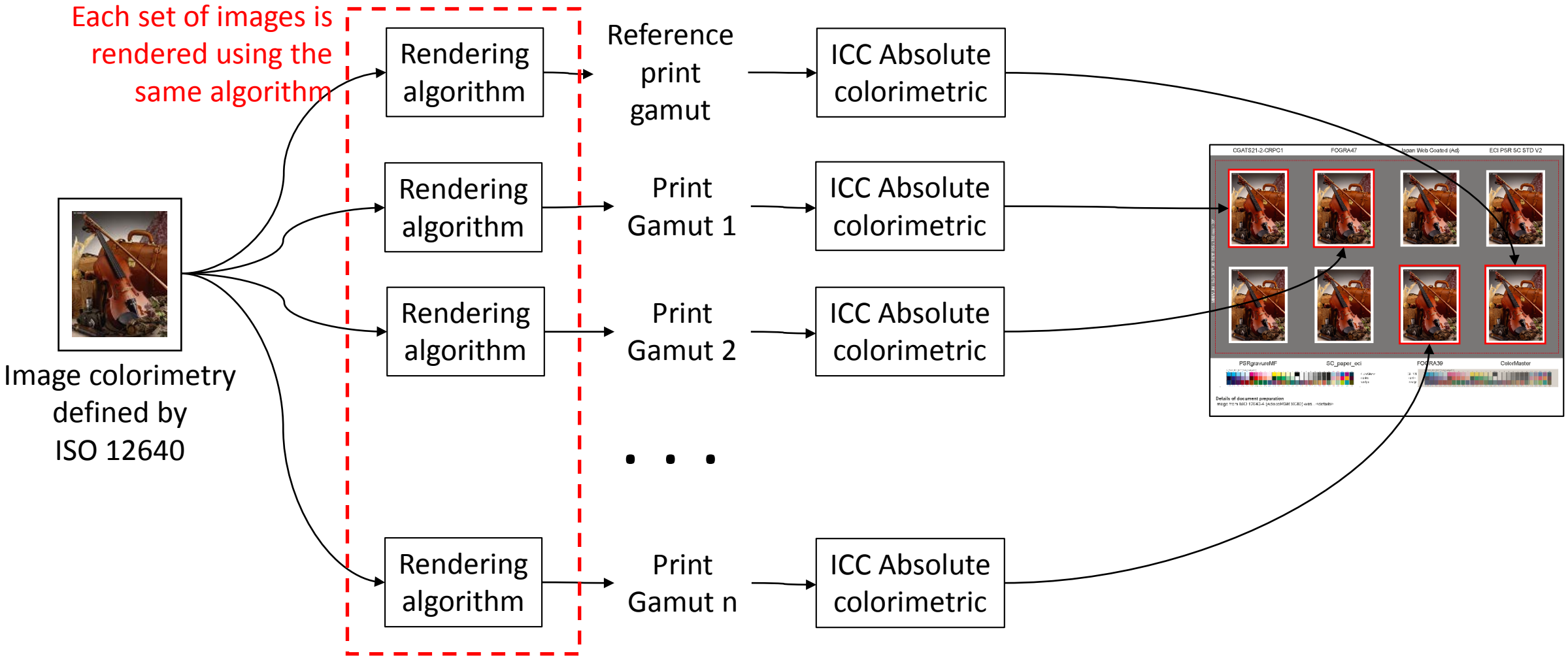
Print Visual Assessment

Print Viewing Environment

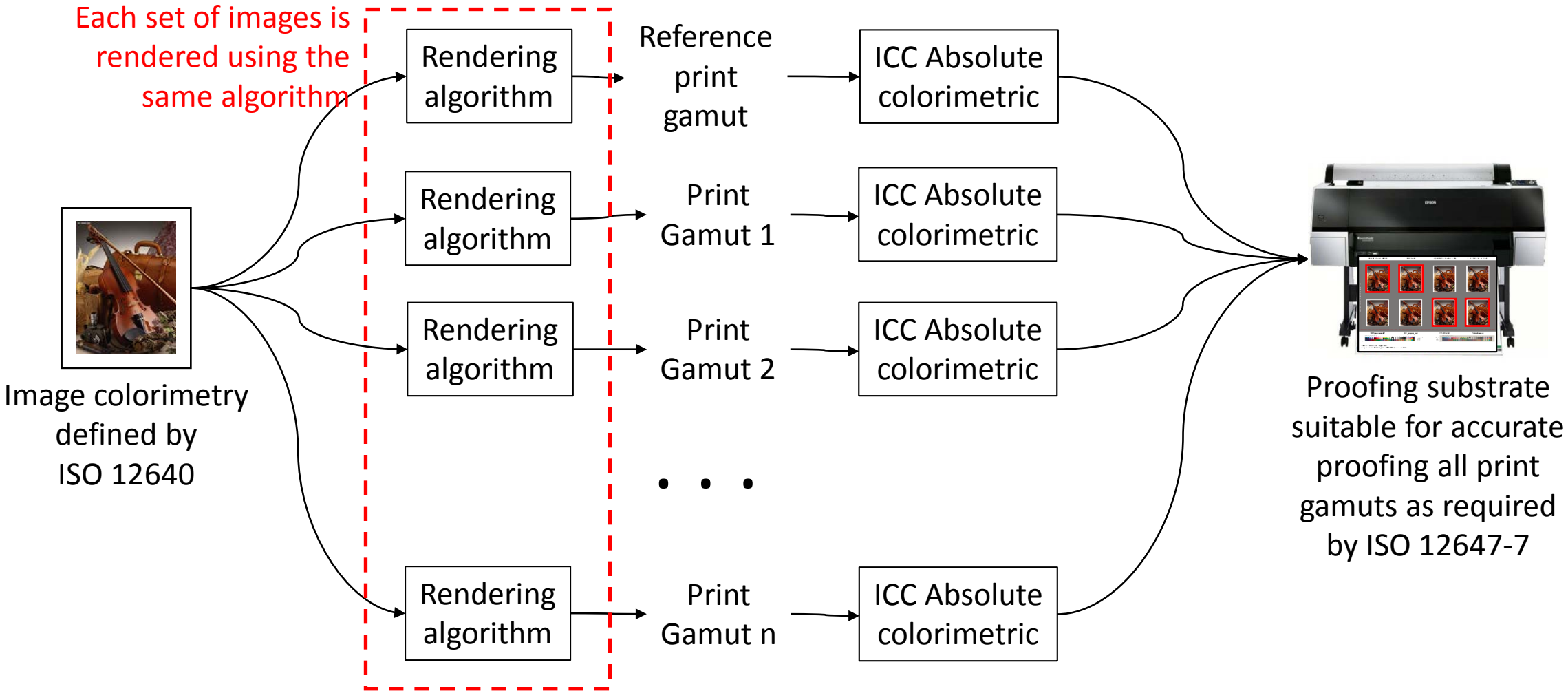
Print measurement and assessment

Consistent Colour Appearance Metric

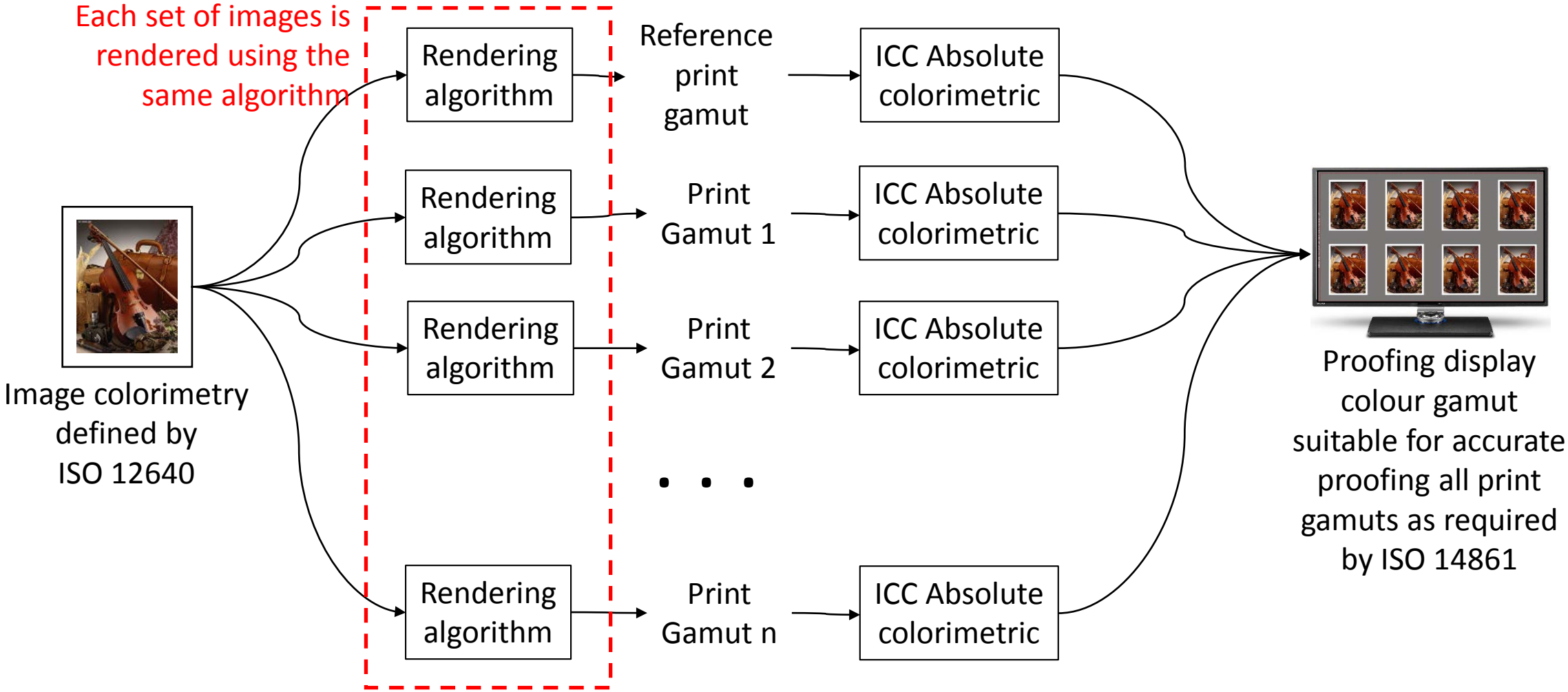
Use of print gamuts



Use of print gamuts (hard copy)



Use of print gamuts (soft copy)



Viewing environment

- ISO 3664:2009 Viewing conditions
- P2 viewing condition
- CIE Illuminant D50
- 500 lx +- 125 lx (same as ICC PCS)

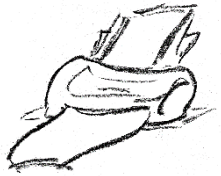
Hard copy proof

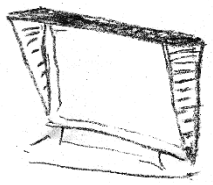
- ISO 12646:2008 Display characteristics and viewing conditions
- ISO 14861:2015 Requirements for colour soft proofing systems
- Display colour gamut must be large enough to simulate all reference print gamuts

Soft copy proof

How could this work in practice?

Flexible print (RGB) workflow





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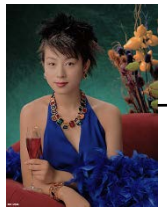

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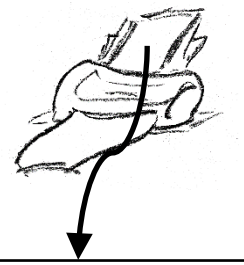
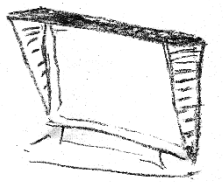


Wide gamut reference printer

Reference print created using CCA algorithm and provided to client as part of contract

Reference control patches

Reference display image



Wide gamut reference display

Reference document created using CCA algorithm and provided to client as part of contract

Print buyer and print provider use calibrated display and standard viewing conditions

Reference control patches

CCA metric compares reference control patches with control patches on production print(s) as part of acceptance procedure

Thank you for your attention