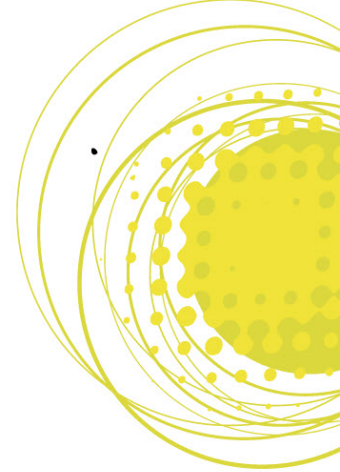
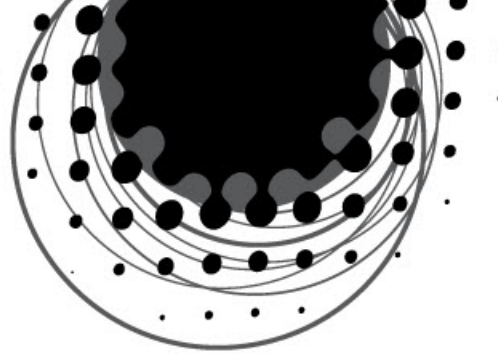




Color Management in Digital Printing

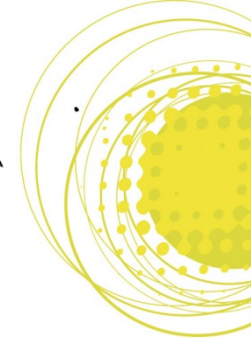
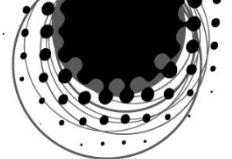
- *Meeting industrial standards* -

Katsuji Kondo
PP Controller Development Division
Production Printing Products System Control Development Center
R&D Headquarters
KONICA MINOLTA, INC.

February 12, 2015 • India Expo Centre • Greater Noida, Delhi NCR

NPES-ICC Color Management Conference 2015
“Manufacturing Success with Color Management”

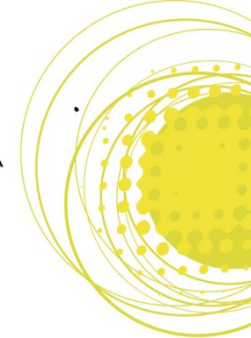
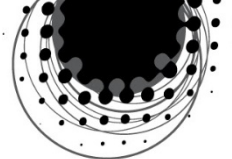




Today's topic

1. Benefits of color management
2. Basics of color management
3. Digital printing practice
4. Conclusion

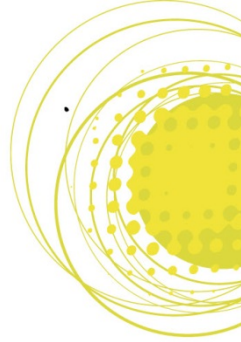
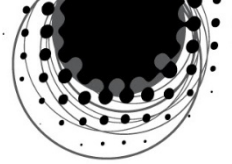




Today's topic

1. Benefits of color management
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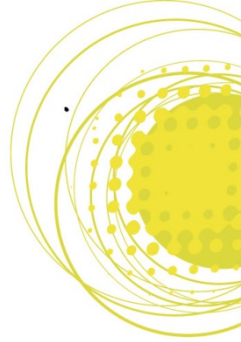
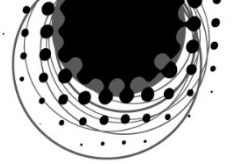




Benefits of color management

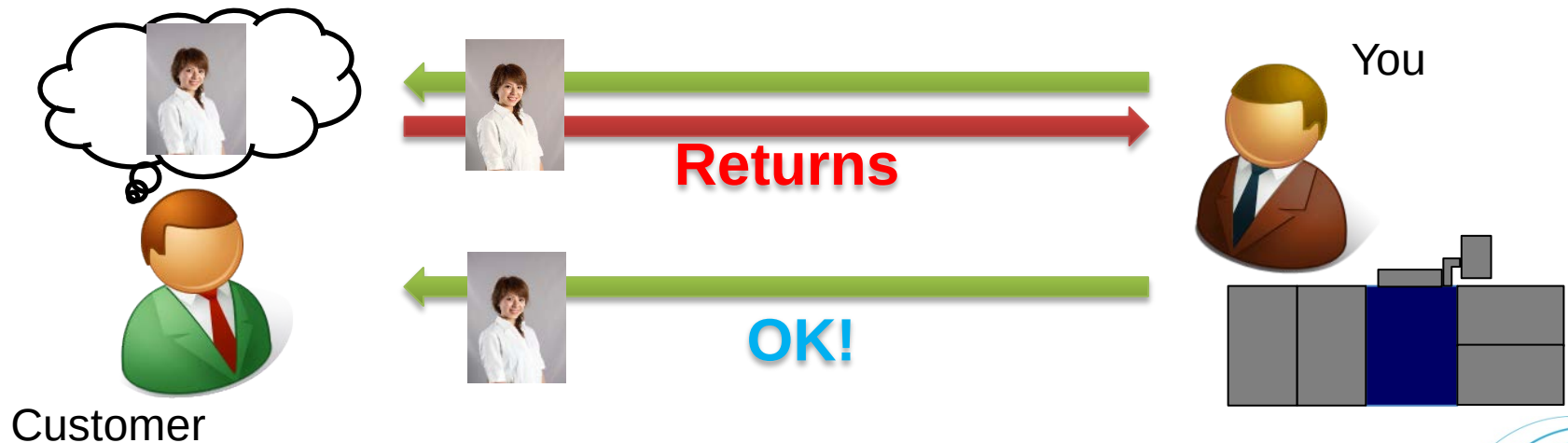
- What is a **good color** for the press?
 - Who judges whether it is?
 - If the color of your delivery doesn't match your customer's expectation. **Returned!**
 - You will need extra time and costs to reprint it.
- We have to ensure the **expected color** of our customers.

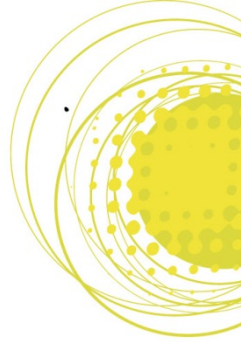
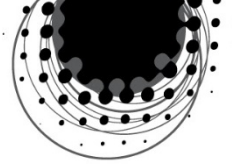




Benefits of color management

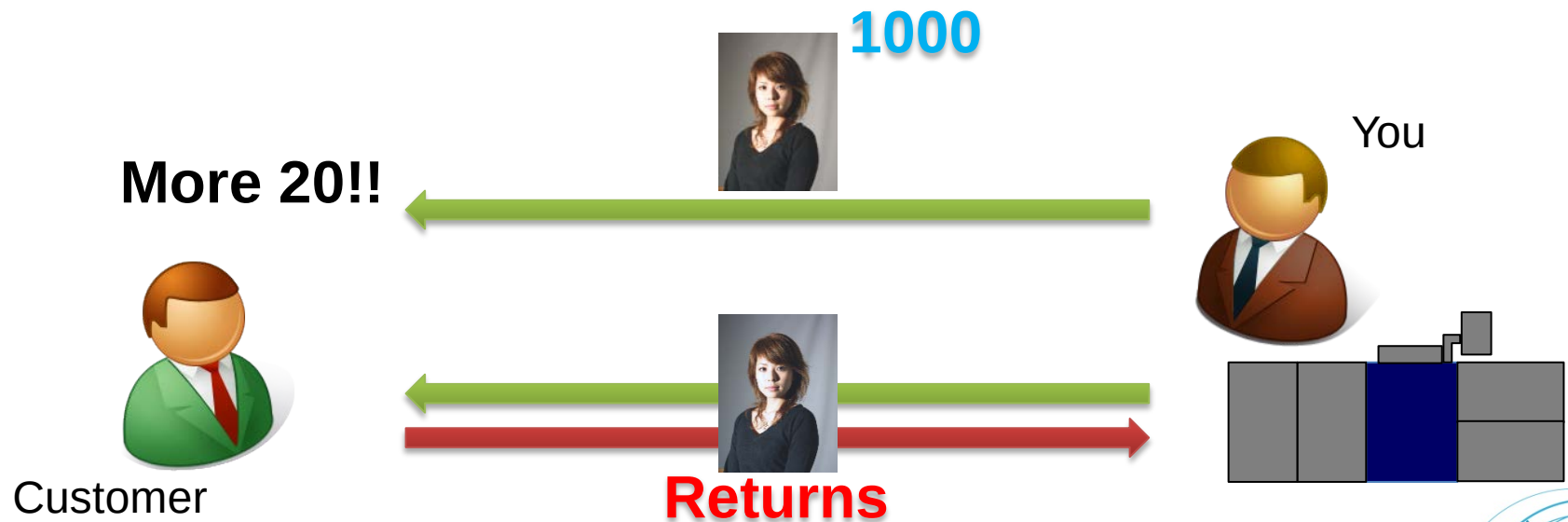
- Regular print job:
 - Your customer has their expectation of the color to be printed
 - In order to prevent **returns**: How can we know it?

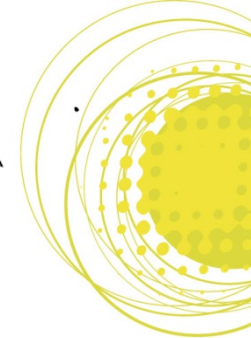
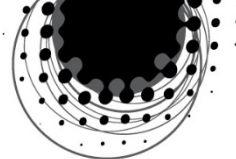




Benefits of color management

- Re-print job:
 - The color of previous version should be the expectation.
 - In order to obtain the **same color again**: We should make sure the color of the previous version.

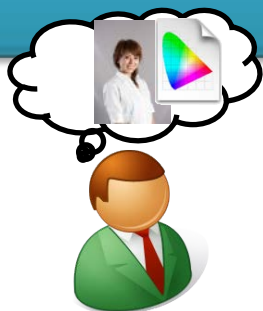




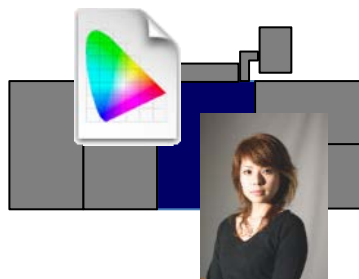
Benefits of color management

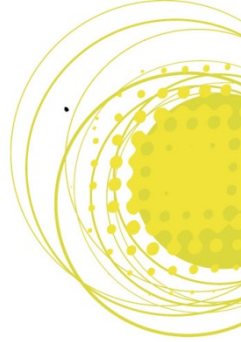
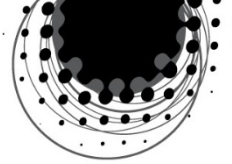
- How can we achieve them?
 - Print the color that matches **customer's expectation**.
 - Print **the same color** as the previous version.
- The answer is to use **color management!**

Expected color of
the image with ICC
Profiles.



Repeatability

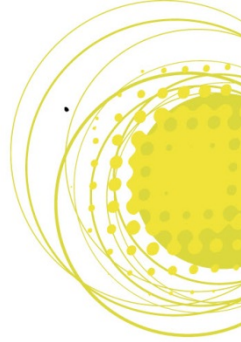
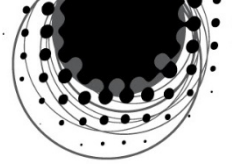




Benefits of color management

- “Digital”, the best partner of color management.
 - Easier operation than plate making
 - Effects real-time to the print job
 - Quick response

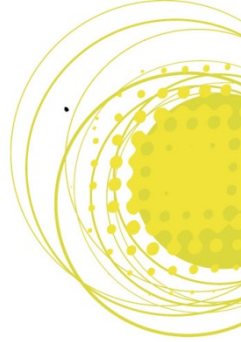
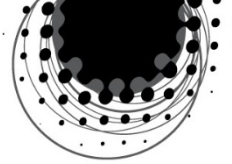




Benefits of color management

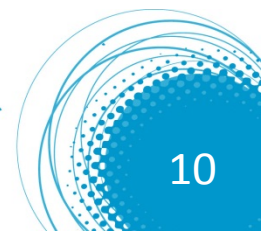
- **New ISO's for digital** are published and being discussed
 - ISO 12647-7,-8(digital proof, validation print)
 - ISO/NP 15311-2(quality requirement)
 - ISO/FDIS 15339-1(color gamut)
- **Digital print certifications** which include color matching requirement is getting **more spotlighted**
 - FOGRA Certification (EU, FOGRA)
 - Digital Print Certification(US, IDEAlliance)
 - Japan Color Certification(JP, JPMA)
- Customer's color expectation will be the color that **meets the standards.**

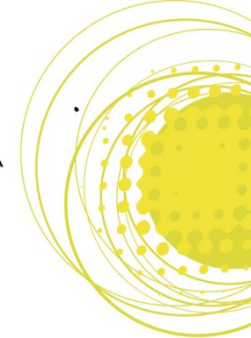
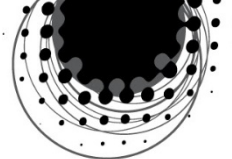




Benefits of color management

- Summary
 - To avoid **returns** in printing business, you should print in a **good color**.
 - Print **the expected color** faithfully.
 - Print the **same color as the previous** version.
 - **Color management** is the answer for achieving the good color.
 - **Industrial standards** for the color are coming up and increasing its presence.

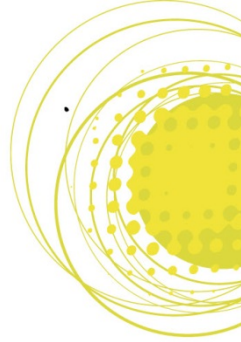
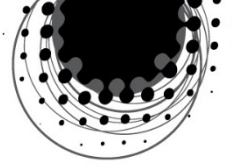




Today's topic

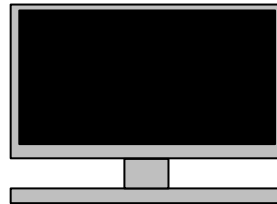
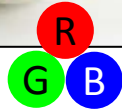
1. Benefits of color management
- 2. Basics of color management**
3. Digital printing practice
4. Conclusion



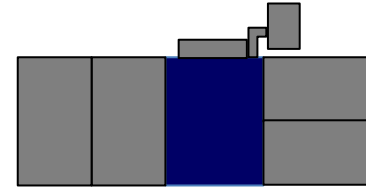


Basics of color management

- We can not interchange device color directly.



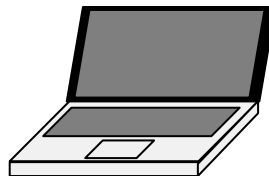
Monitor



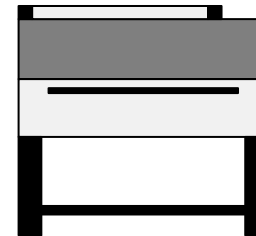
EP Printer



The value indicate the color of each device
Such as RGB value or CMYK value
Device dependent color

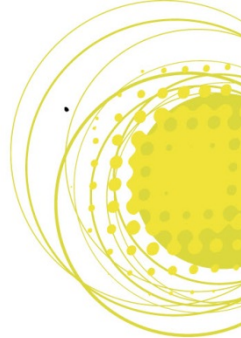
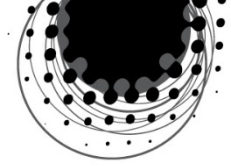


Laptop



Inkjet printer

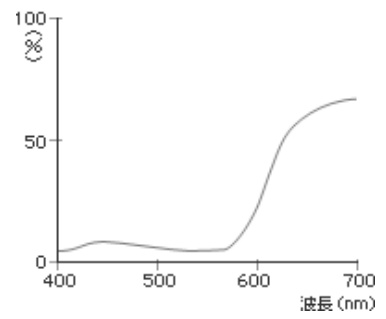




Basics of color management

- Device independent color

■ XYZ value (tristimulus)



$$\int P(\lambda) \cdot R(\lambda) \cdot \begin{Bmatrix} \bar{x}(\lambda) \\ \bar{y}(\lambda) \\ \bar{z}(\lambda) \end{Bmatrix} = \begin{Bmatrix} X \\ Y \\ Z \end{Bmatrix}$$

■ L*a*b* value

spectral reflectivity $R(\lambda)$

or

spectral radiance $L(\lambda)$

$$L^* = 116 f(Y/Y_n) - 16$$

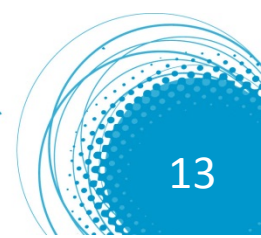
$$a^* = 500 [f(X/X_n) - f(Y/Y_n)]$$

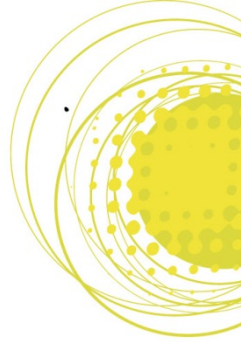
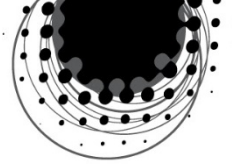
$$b^* = 200 [f(Y/Y_n) - f(Z/Z_n)]$$



The color value which can identify color
independently to device

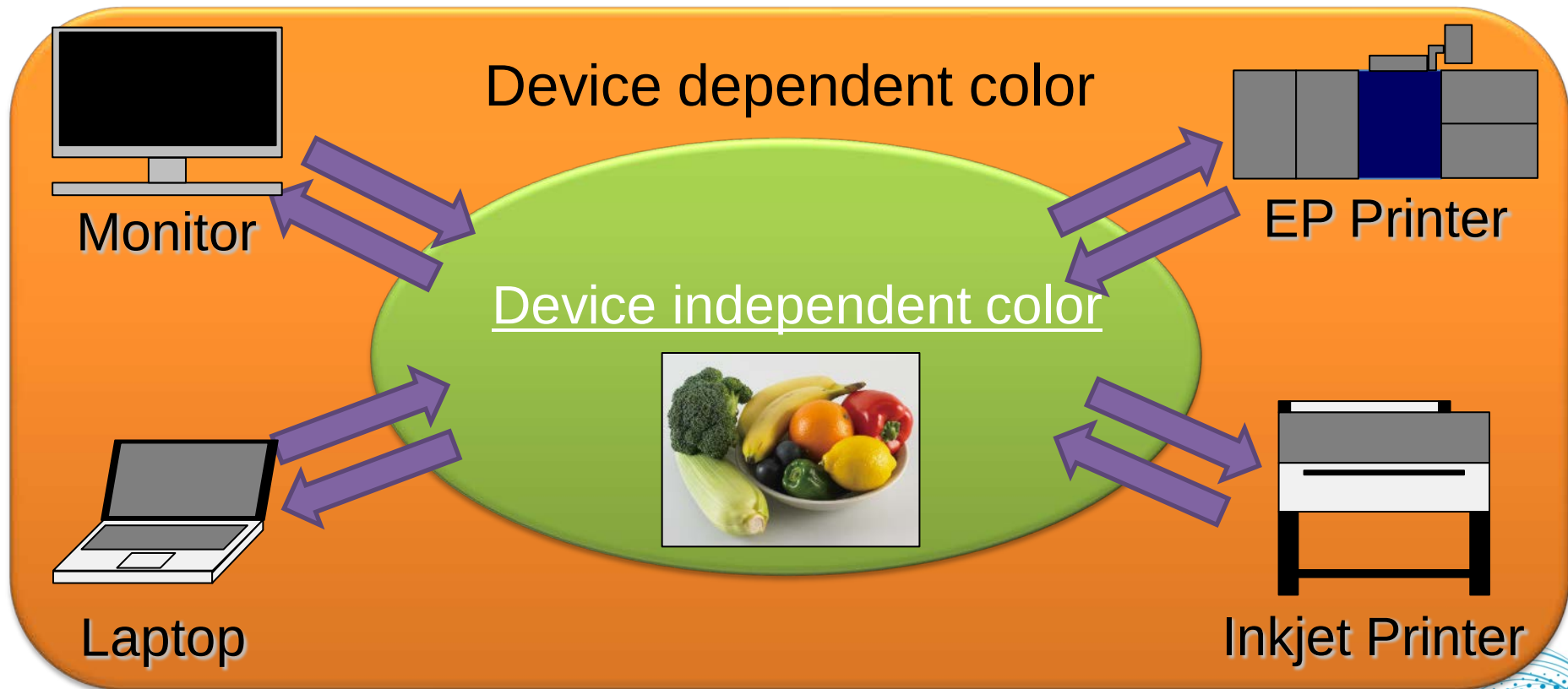
Device independent color

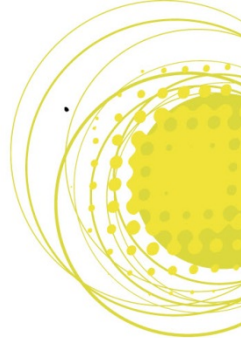
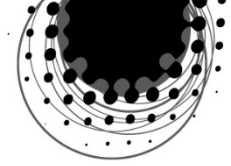




Basics of color management

- Color Communication via device independent color

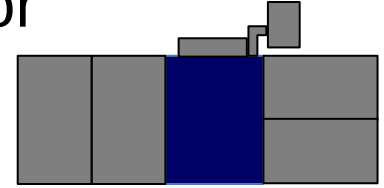




Basics of color management

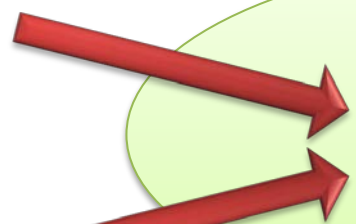
- Color Matching via device independent color

C	M	Y	K	L*	a*	b*
0	0	0	0	94	89	80
10	0	0	0	91	87	75
0	10	0	0	97	95	68
:	:	:	:	:	:	:



L*	a*	b*	C	M	Y	K
0	0	0	93	88	89	80
10	0	0	81	91	87	75
20	0	0	69	97	95	68
:	:	:	:	:	:	:

C,M,Y,K



L*,a*,b*

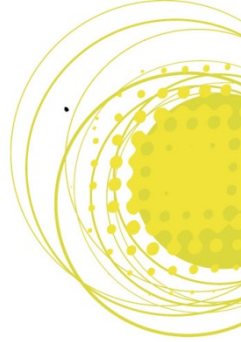
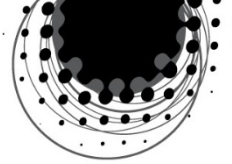


C,M,Y,K

R,G,B

R	G	B	L*	a*	b*
0	0	0	0	0	0
25	0	0	2	9	3
50	0	0	6	25	10
:	:	:	:	:	:





Basics of color management

- ICC Profile
 - Color Profile compliant with the specification defined by ICC (International Color Consortium)
 - It includes both tables from and to between **device dependent color** and **device independent color**

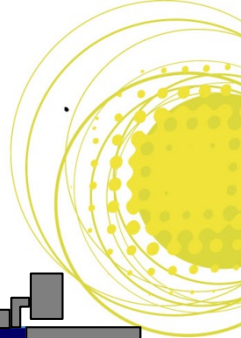
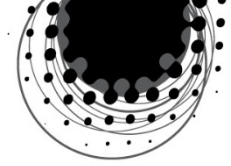
C,M,Y,K → L*,a*,b*

C	M	Y	K	L*	a*	b*
0	0	0	0	94	89	80
10	0	0	0	91	87	75
0	10	0	0	97	95	68
:	:	:	:	:	:	:



L*,a*,b* → C,M,Y,K

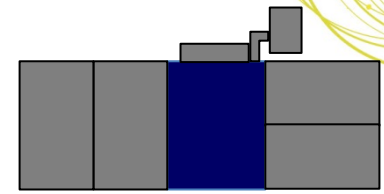
L*	a*	b*	C	M	Y	K
0	0	0	93	88	89	80
10	0	0	81	91	87	75
20	0	0	69	97	95	68
:	:	:	:	:	:	:



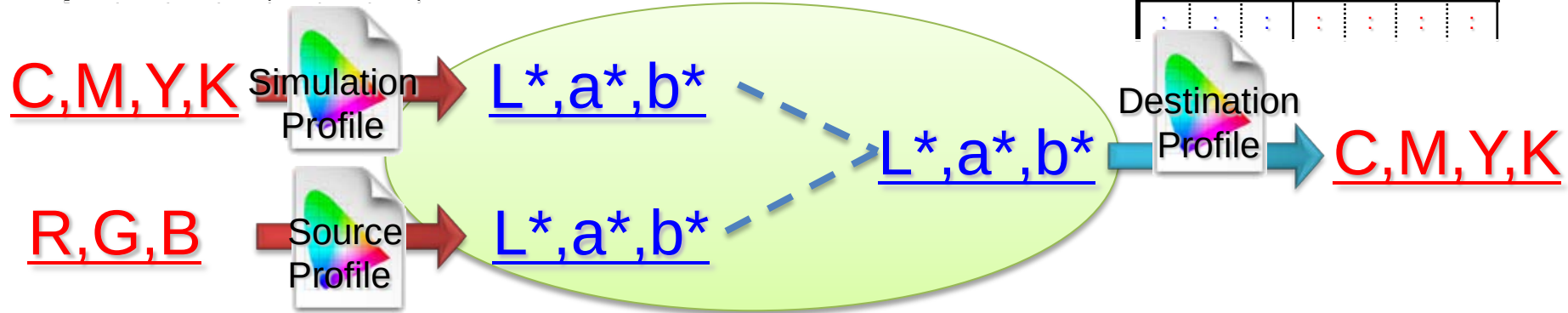
Basics of color management

- Color Matching with ICC Profiles

C	M	Y	K	L*	a*	b*
0	0	0	0	94	89	80
10	0	0	0	91	87	75
0	10	0	0	97	95	68
:	:	:	:	:	:	:

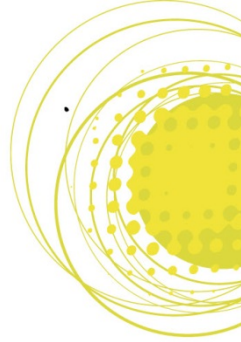
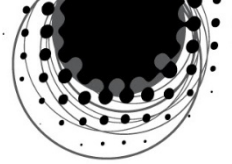


L*	a*	b*	C	M	Y	K
0	0	0	93	88	89	80
10	0	0	81	91	87	75
20	0	0	69	97	95	68
:	:	:	:	:	:	:



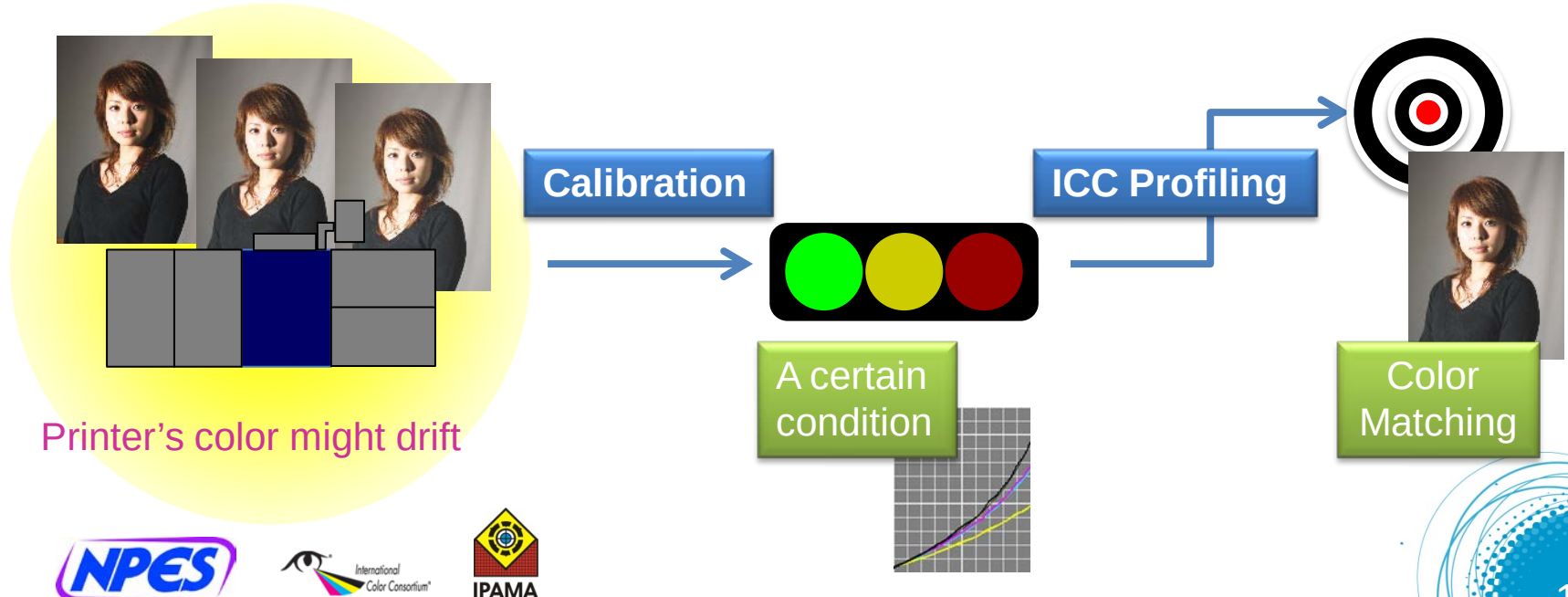
R	G	B	L*	a*	b*
0	0	0	0	0	0
25	0	0	2	9	3
50	0	0	6	25	10
:	:	:	:	:	:

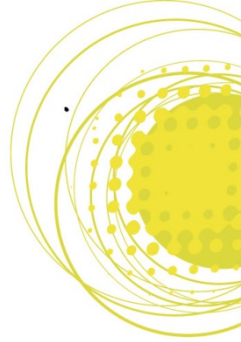
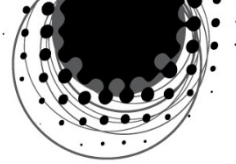




Basics of color management

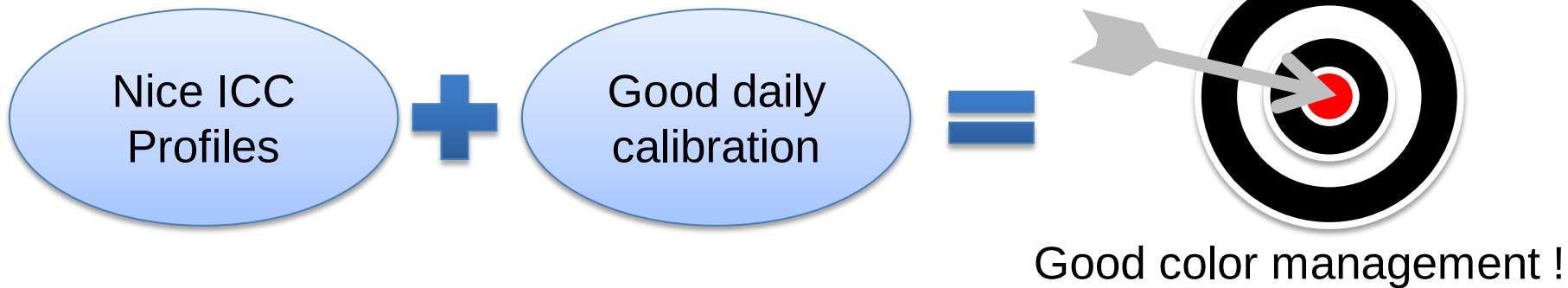
- Color matching with ICC profiles is **NOT THE ALL** about color management.
 - **Calibration** for keeping the printers consistency is also very important.
 - ICC profiling and calibration are two sides of the same coin

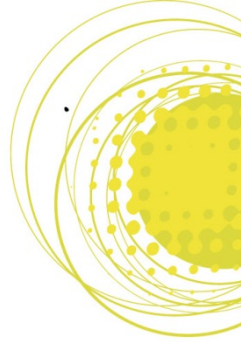
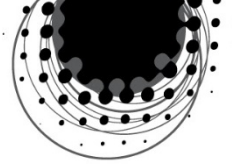




Basics of color management

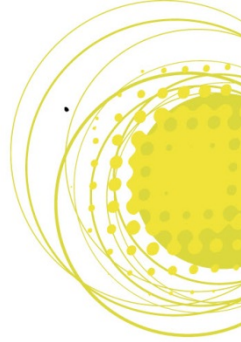
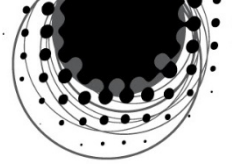
- Recommendation for your printing operation
 - Make a good color matching at first.
 - Well prepared ICC profiles.
 - Keep consistency.
 - Do the calibration everyday.





Basics of color management

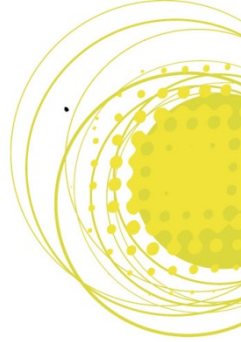
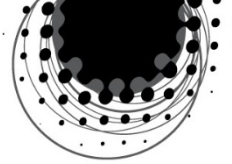
- Summary
 - Color matching is the **color communication** between devices.
 - **Device independent color** should be used in order to achieve color communication.
 - **A pair of ICC Profiles** derives color matching among 2 devices.
 - **Calibration** that keeps color consistency of printers is also very important.



Today's topic

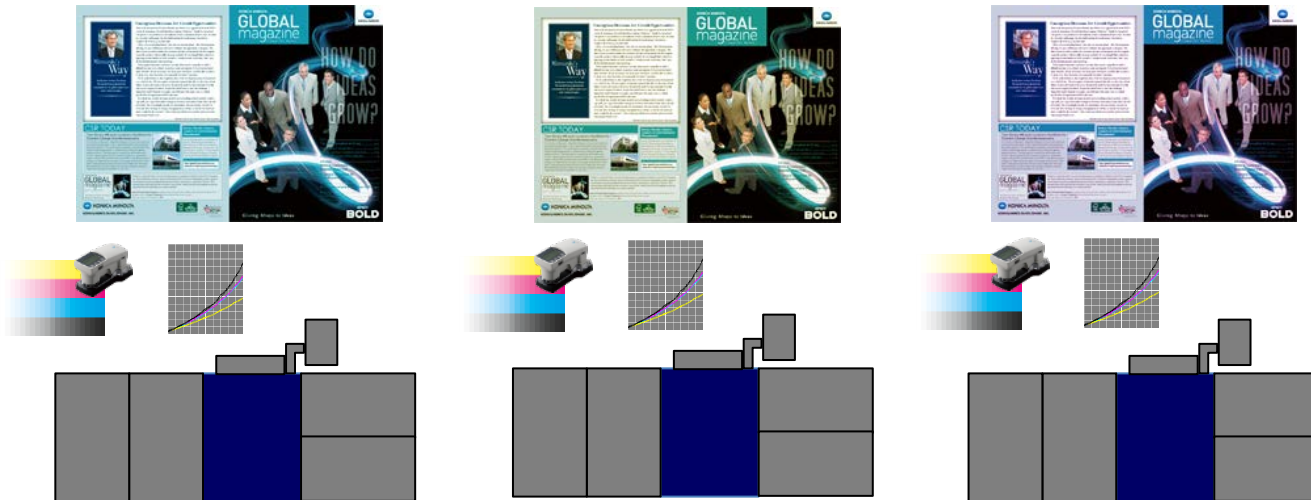
1. Benefits of color management
2. Basics of color management
- 3. Digital printing practice**
4. Conclusion

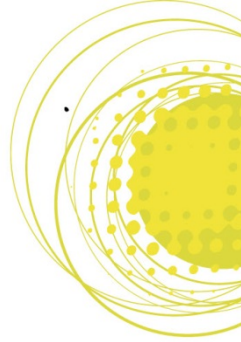
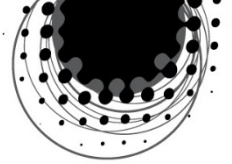




Digital printing practice

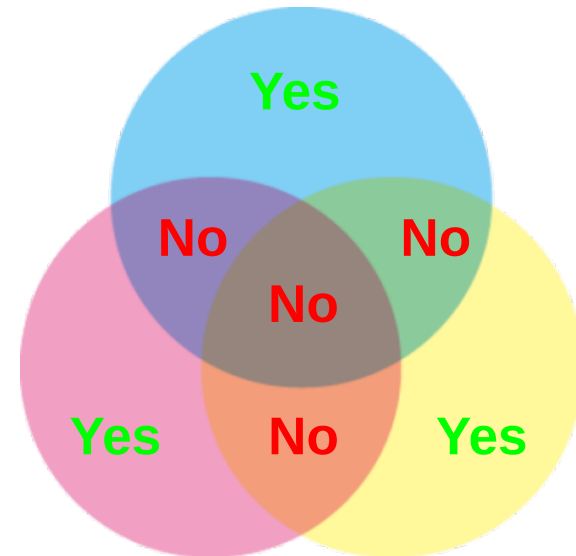
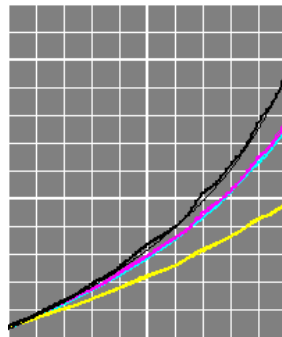
- Challenge
 - Color balance might vary with changing of climate
 - Inter-device differences
 - Sometimes, conventional calibration cannot correct them.

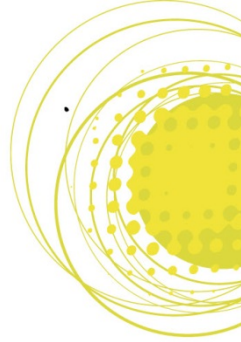
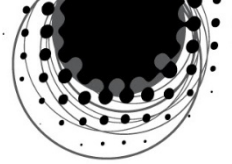




Digital printing practice

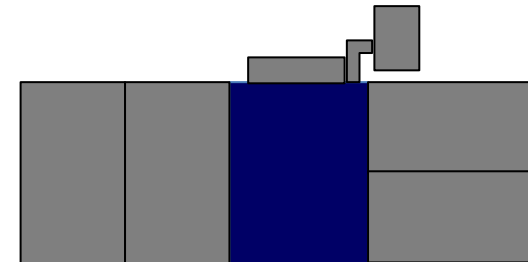
- Why calibration is not perfect?
 - Conventional calibration only corrects each mono color gradations
 - Color balance calibration at the right time is necessary

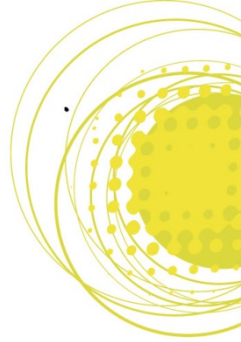
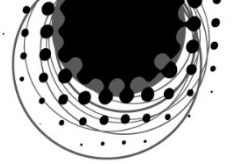




Digital printing practice

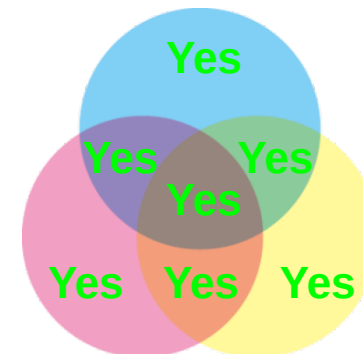
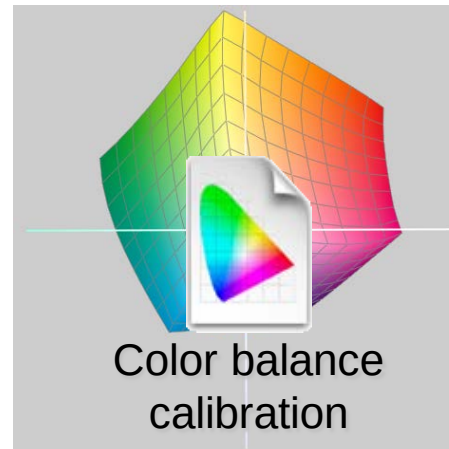
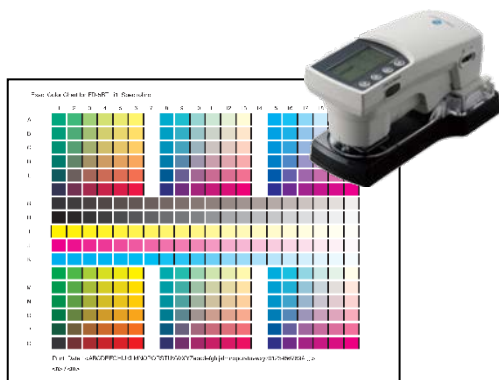
- So, what to do in the case color balance varied?
 - Re-Profiling?
 - Require many (928, 1617) color patches to measure
 - Hard and professional work
 - At least 30 minutes for each device

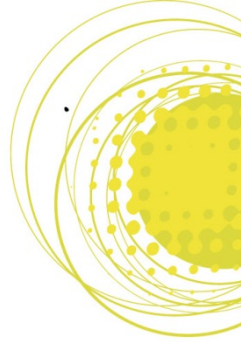
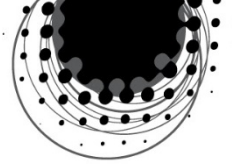




Digital printing practice

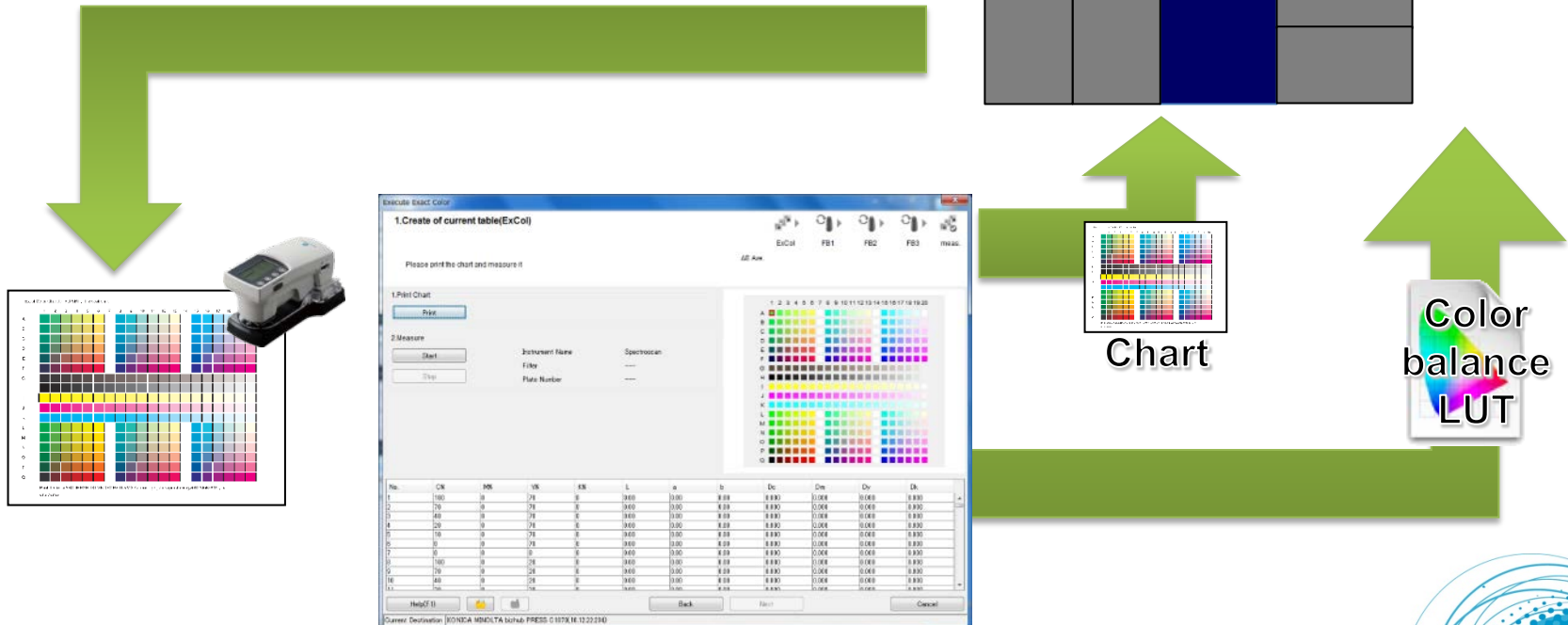
- Using color matching technology for the color balance calibration.
 - Recent topic of digital printing system.
 - Color balance calibration in whole gamut.
 - Specialized calibration LUT with less amount of patches.
 - Achievable with only a few minutes.

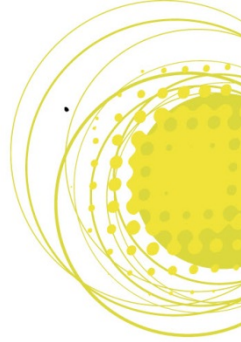
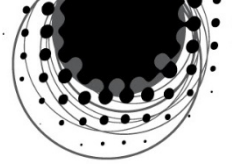




Digital printing practice

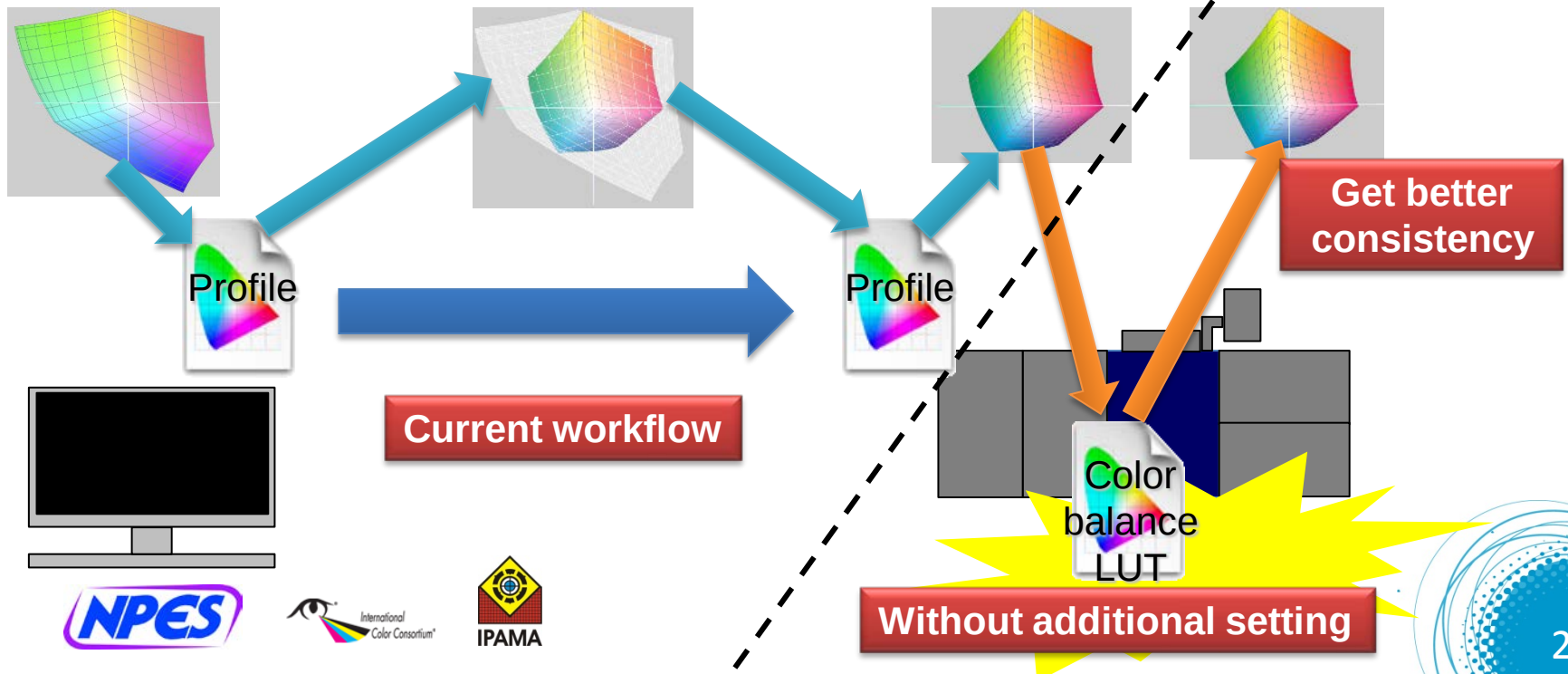
- Simple operation
 - With wizard guiding measurement of the patches and registering LUT to the device.

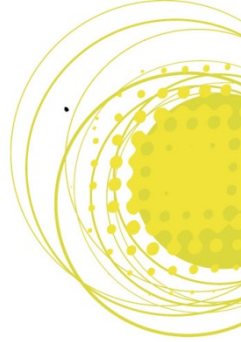
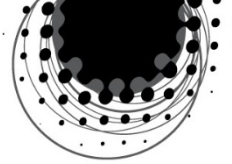




Digital printing practice

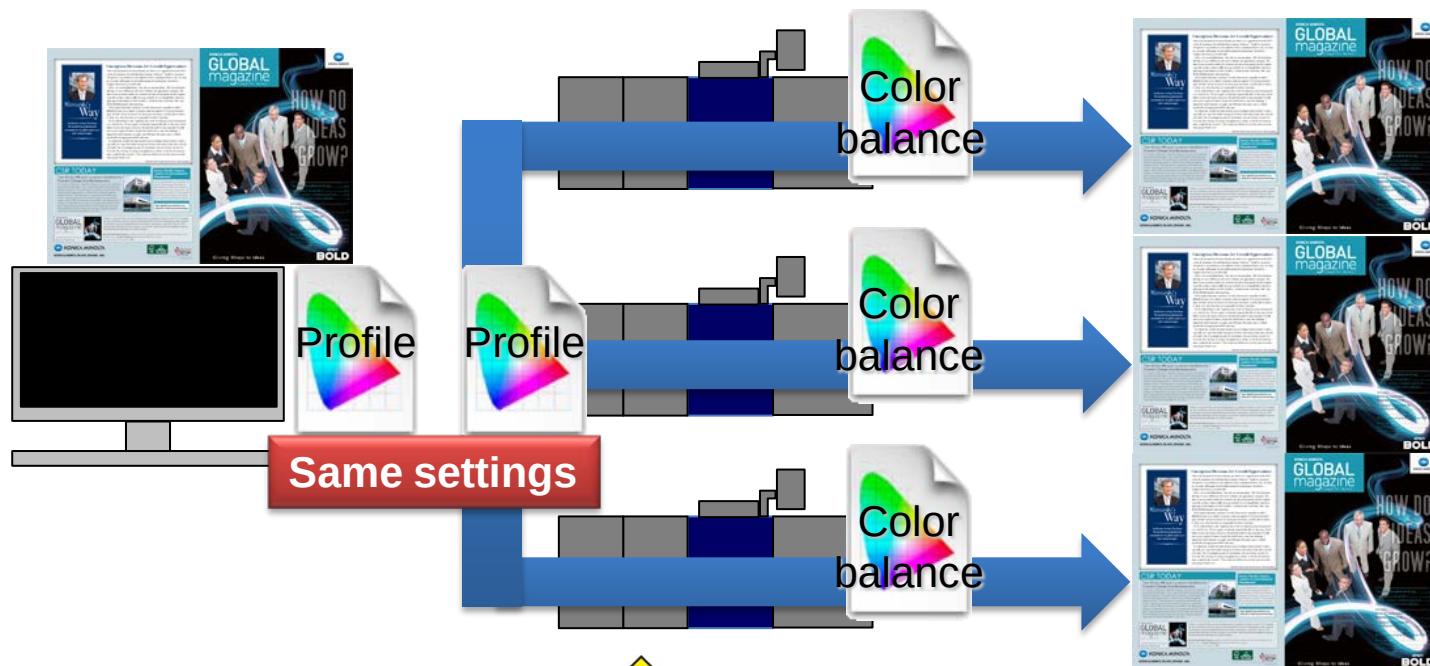
- Easy integration into the current print workflow
 - It can work automatically in the **background RIP**
 - **No additional step** in print operation.
 - Easy way to get **better color consistency**.

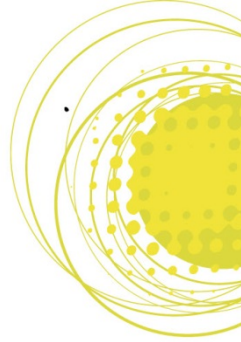
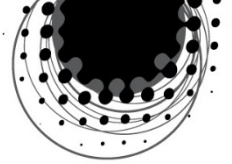




Digital printing practice

- It can work as **inter-device calibration**
 - One profile to multiple devices
 - Easy color management for **multi-machine environment**.

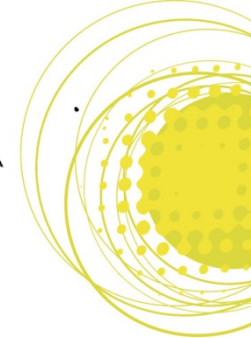
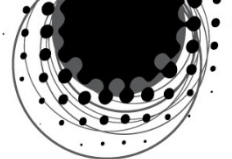




Digital printing practice

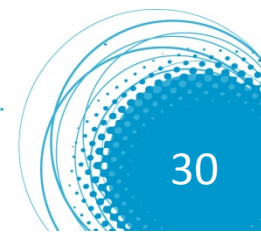
- Ordinary recommend operation (w/o color balance calib.)
 - Calibration : everyday
 - Color Profiling : when you feel color shifting
 - It required some color management knowledge.
- New recommend operation (with color balance calib.)
 - Calibration : everyday
 - Color balance : every 2-3 months
 - Color Profiling : (Initial installation)
 - Easy way to get good color consistency.

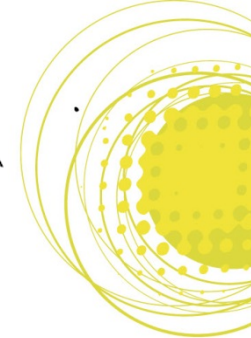
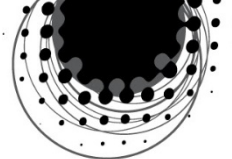




Digital printing practice

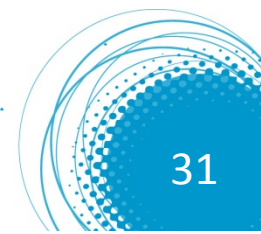
- Summary
 - Advanced calibration for the color balances.
 - It also can give you an inter-device consistency.

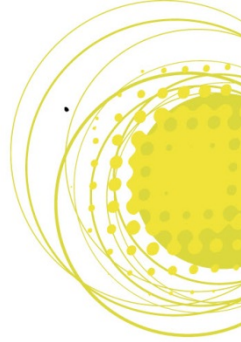
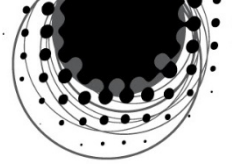




Today's topic

1. Benefits of color management
2. Basics of color management
3. Digital printing practice
4. Conclusion





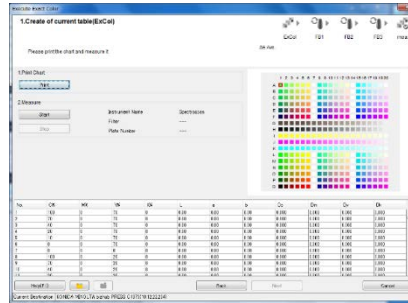
Konica Minolta

- Color management suite
 - Konica Minolta's **total color management solution** will bring you to the **industrial standard and new waves.**

FD-5
Spectrophotometer



OWN controller
Color management

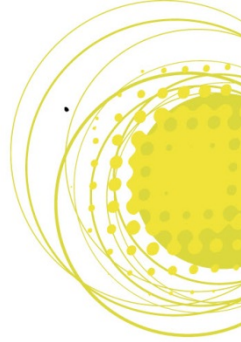
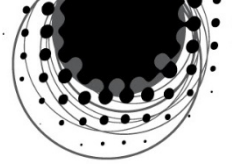


bizhub PRESS
Offset like quality



bizhub PRESS
High Chroma





Conclusion

1. Benefits of color management

- Avoid returns in your business and get your customers confidence by meeting the industrial standards with color management.

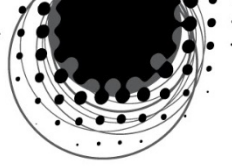
2. Basics of color management

- Color matching basis with going through device independent colors.
- Calibration gives you the device consistency.

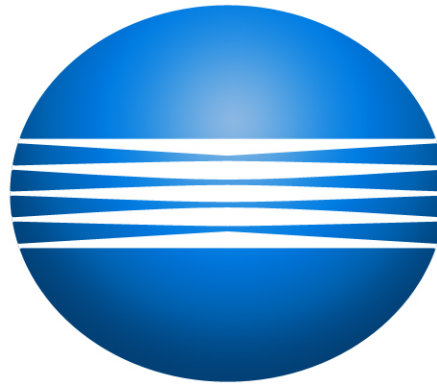
3. Digital printing practice

- Advanced calibration for the color balance.





Thank you very much for this opportunity!



KONICA MINOLTA

Giving Shape to Ideas

