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Overlapped heptachromy in rotogravure printing: critical aspects and chromatic considerations

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The aim of this paper:

Contribute to define and clarify pros and cons of Heptachromy printing.

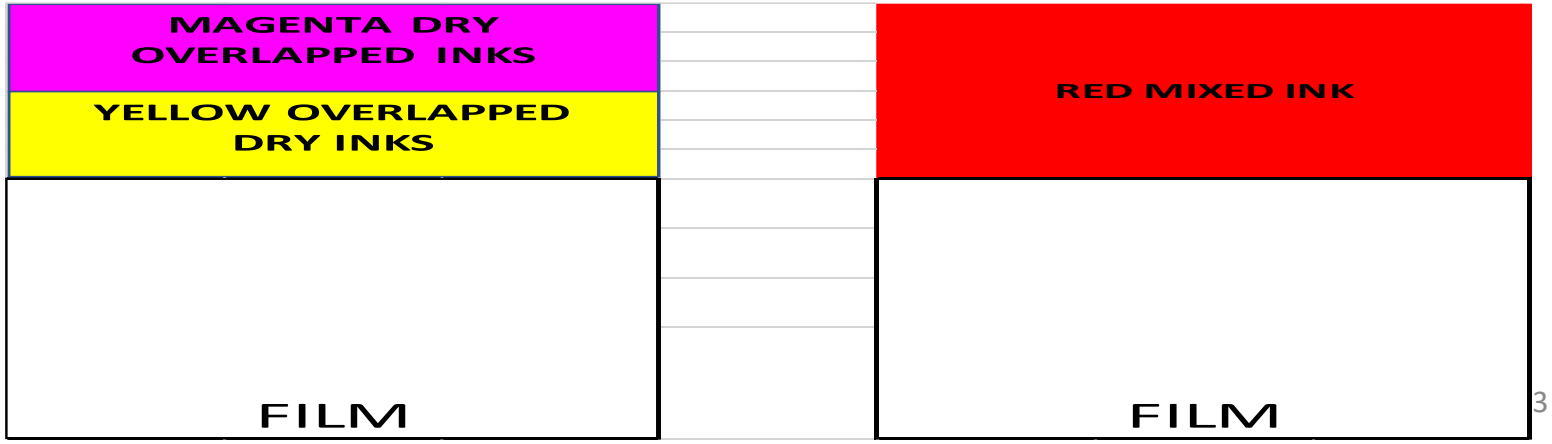
Before starting

Some simple basic clarifications

1- CMYK = Quadrichromy =

2- CMYKOGV = Heptachromy = Cyan+ Magenta+ Yellow+ Black+ Orange +Green +Violet=

3- Overlapped and mixed printed inks



Before starting
some other observations regarding material and chromatic conditions adopted:

1. *Nitro inks used, monosolvent ethilacetate based, CMYKOVG plus White full coprence;*
2. *20 microns transparent PP film;*
3. *Konika Minolta FD7 and FD9 spectrophotodensitometers D50/2° M0 regulated;*
4. *Cielab* 1976 L*a*b* system adopted;*
5. *DeltaE* Cielab* 1976 : $\sqrt{(DL*^2+Da*^2+Db*^2)}$.*

Traditional rotogravure printing approach:

<u>Two separate and different ways to print:</u>

1- ***CMYK Overlapped inks***, dry on dry color, for images, faces, products, etc.
2- ***CMYKOGV (and more) Mixed inks*** and after print for spot colors.

Optical density average normally used from converters =1,6.

Heptachromy (new) rotogravure printing approach:

Only one way to print leaving always same inks into the rotogravure machine

CMYKOGV **overlapped inks**, dry on dry color, for images, faces, products **and for standard spot colors too.**

1,6 = same optical density average of quadrichromy observed on some samples from the market

Heptachromy main goals declared:

- **Cost reduction**
- **Environmental impact reduction**
- **Majority standard spot colors emulation using overlapped and no mixed inks**

In other words:

- **Minimize waste**
- **Minimize machine washing time**
- **Minimize return inks**

The core questions:

1- Wich one is the best condition of printing overlapped inks to emulate majority of standard spot colors?

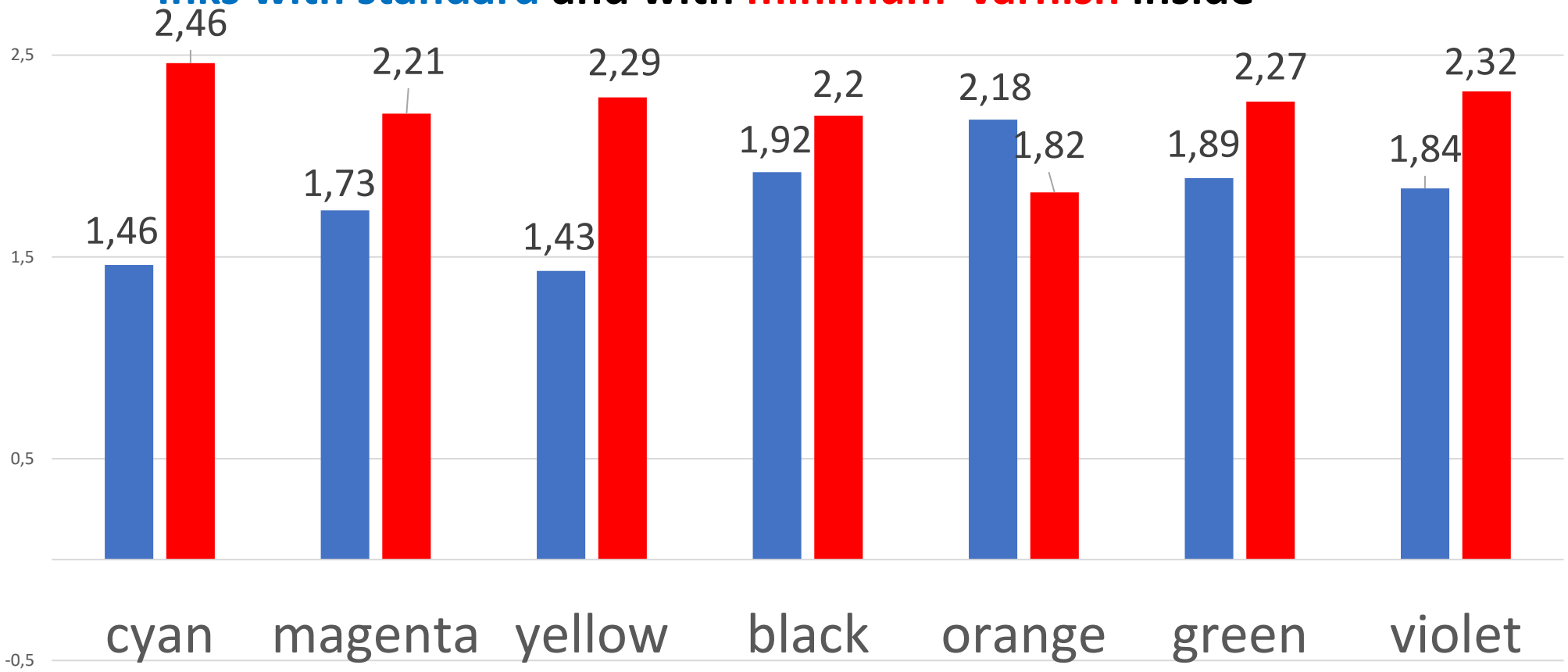
2- Is the standard average optical density 1.6 , used for quadrichromy, able to reach this result?

In order to give answers based on scientific experimental method of investigation we have designed and built a complete new Fingerprint with overlapped inks with:

- **Minimum and standard percentage of varnish inside to test both optical density conditions : average 2,2 and 1,6**
- **Maximum number possible of overlapped spot colors**

Optical density

Inks with standard and with minimum varnish inside



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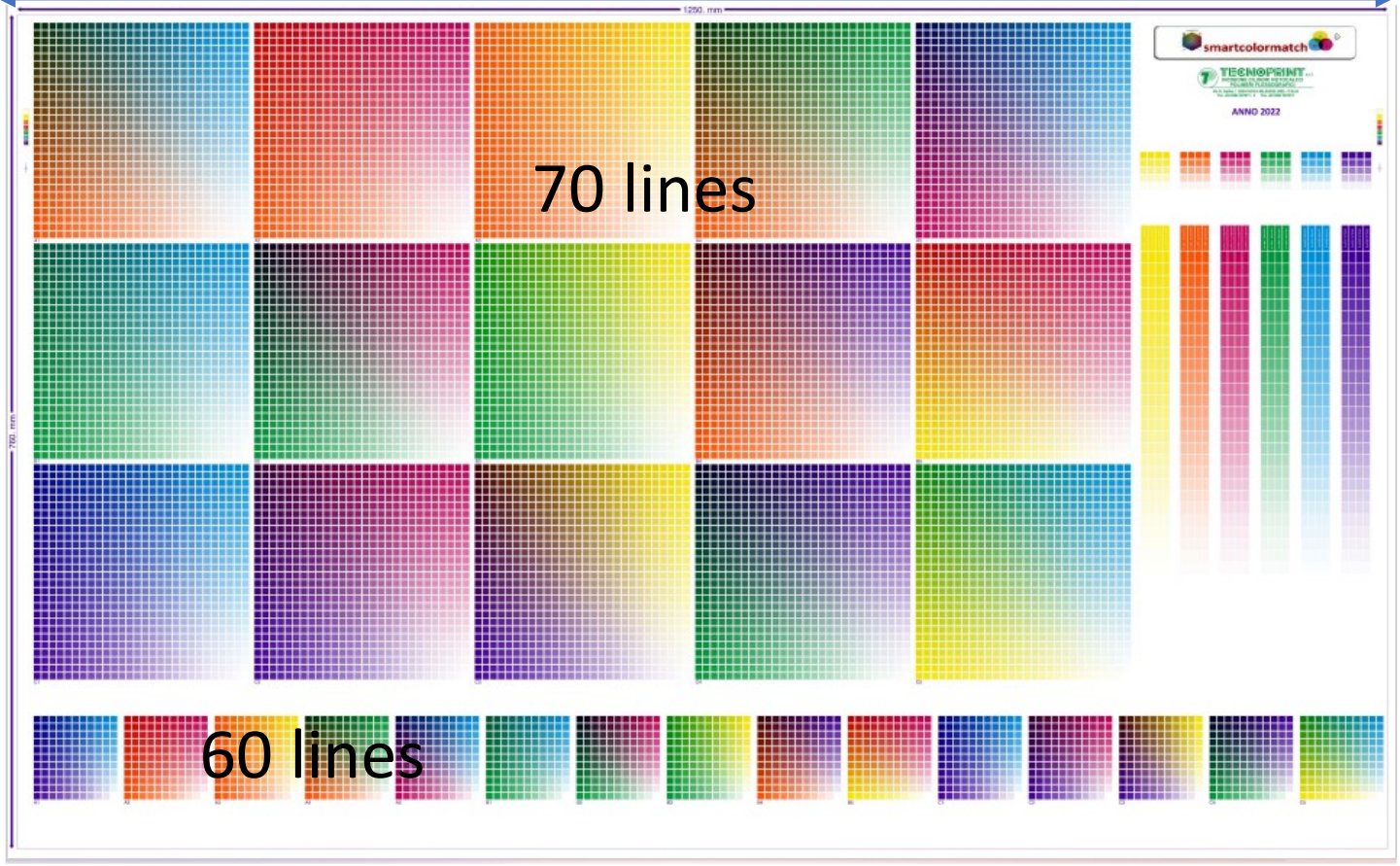
2022New **Smartcolormatch Fingerprint** printed with industrial engraved cylinders and overlapped inks, initially on industrial **test proof machine** on 20 microns transparent PP and later on rotogravure print high speed

TABLE WIDTH : 1250 MM



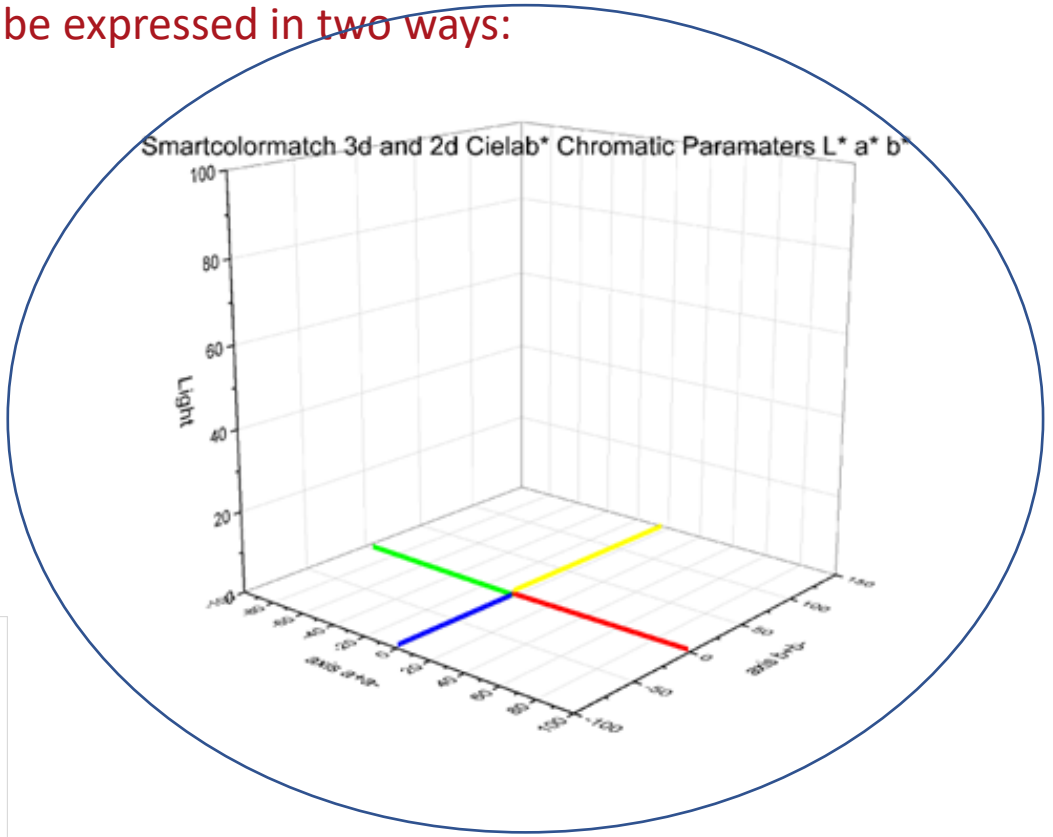
1. **18.000 colors overlapped printed spot colors.**
2. **Inks with minimum and standard amount of varnish;**
3. **70 and 60 lines**
4. **125° Pyramid engraving diamond**

CYLINDER CIRCUNFERENCE : 820 MM

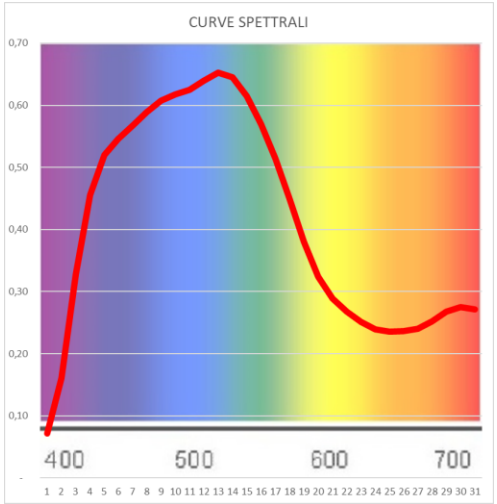
Each color can be detected with a spectrophotometer and can be expressed in two ways:

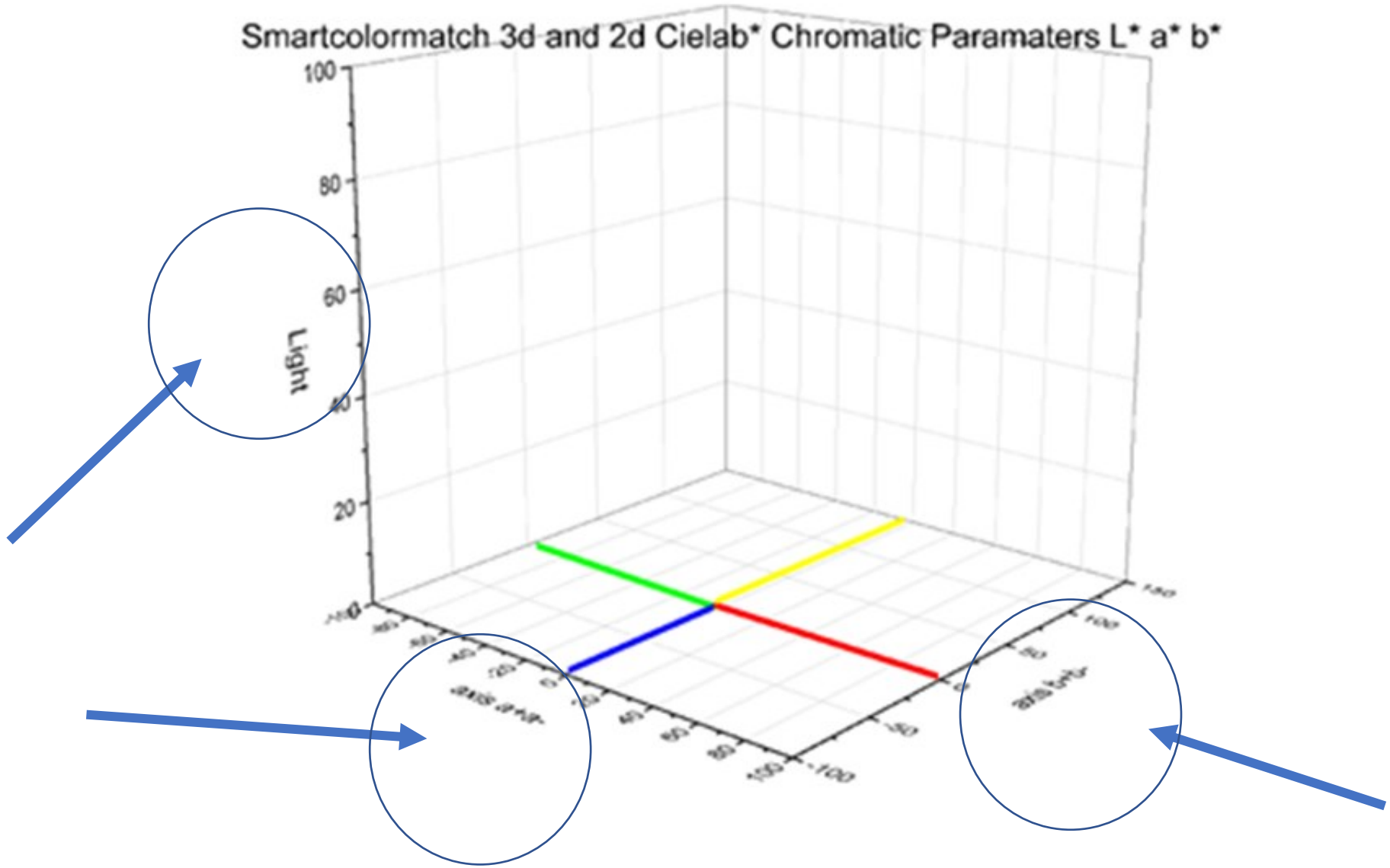
1. L* a*b* coordinates

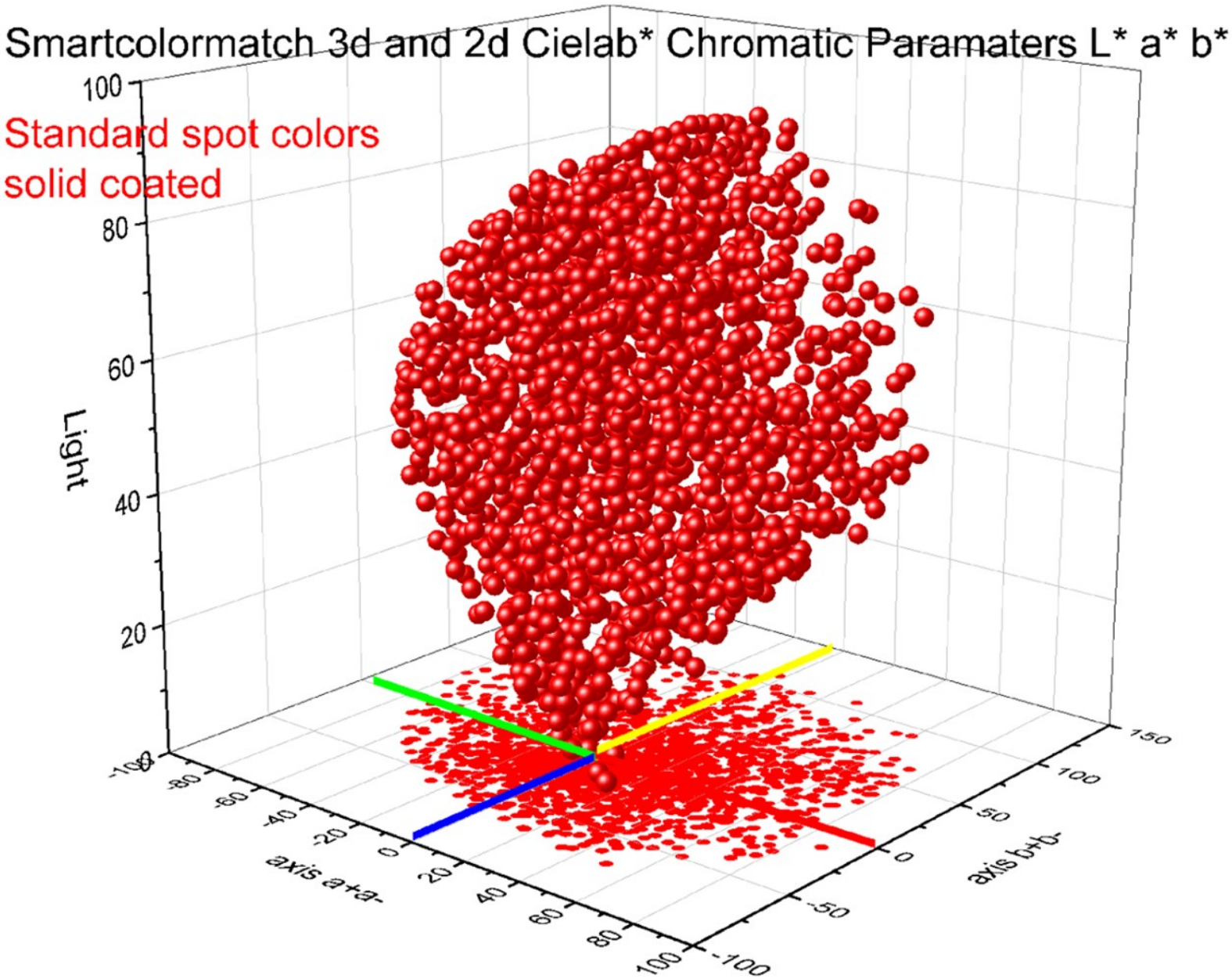
- L*= Light
- a*= green-red axis
- b*= yellow -blue axis

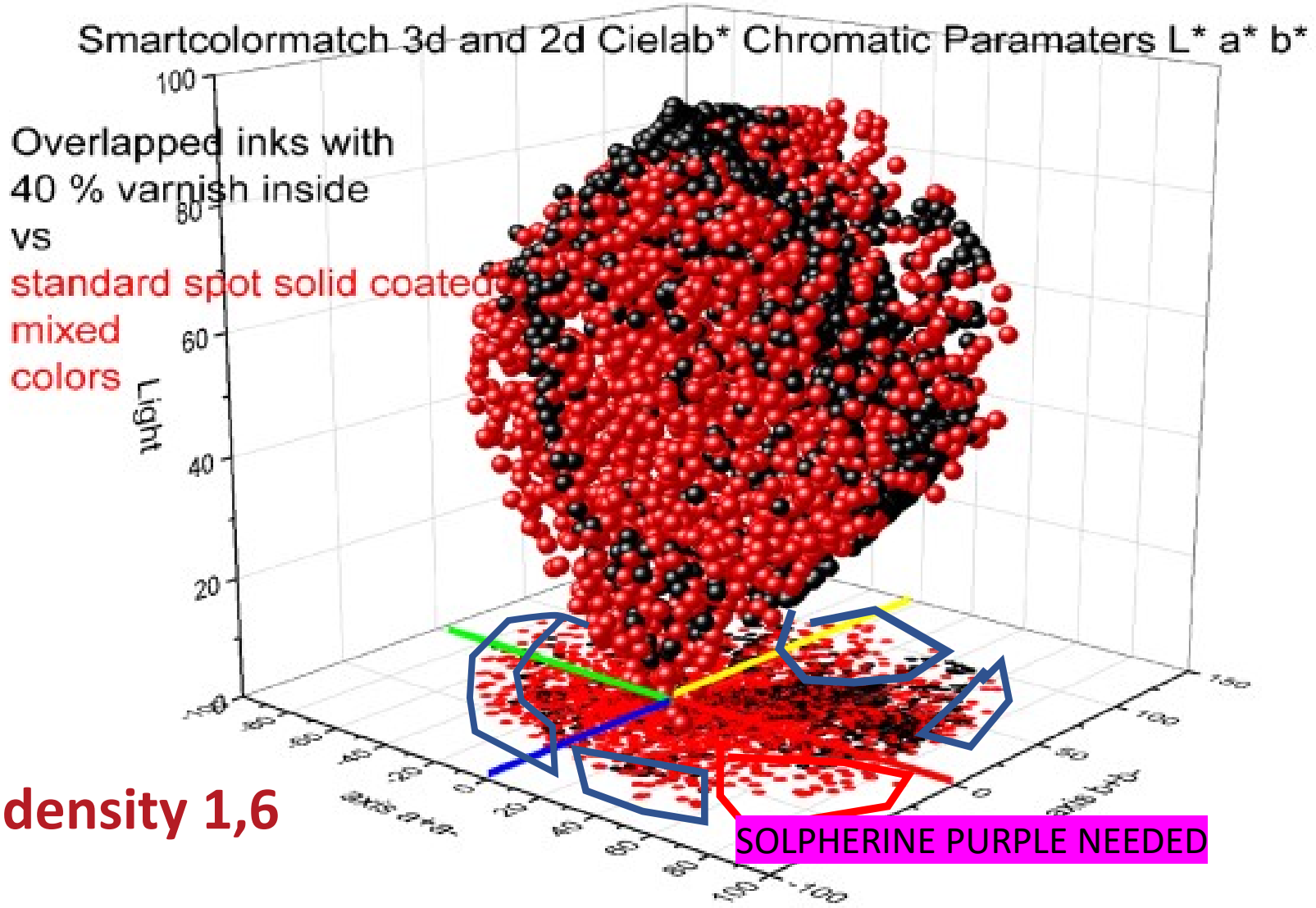


2. Spectroreflectance response

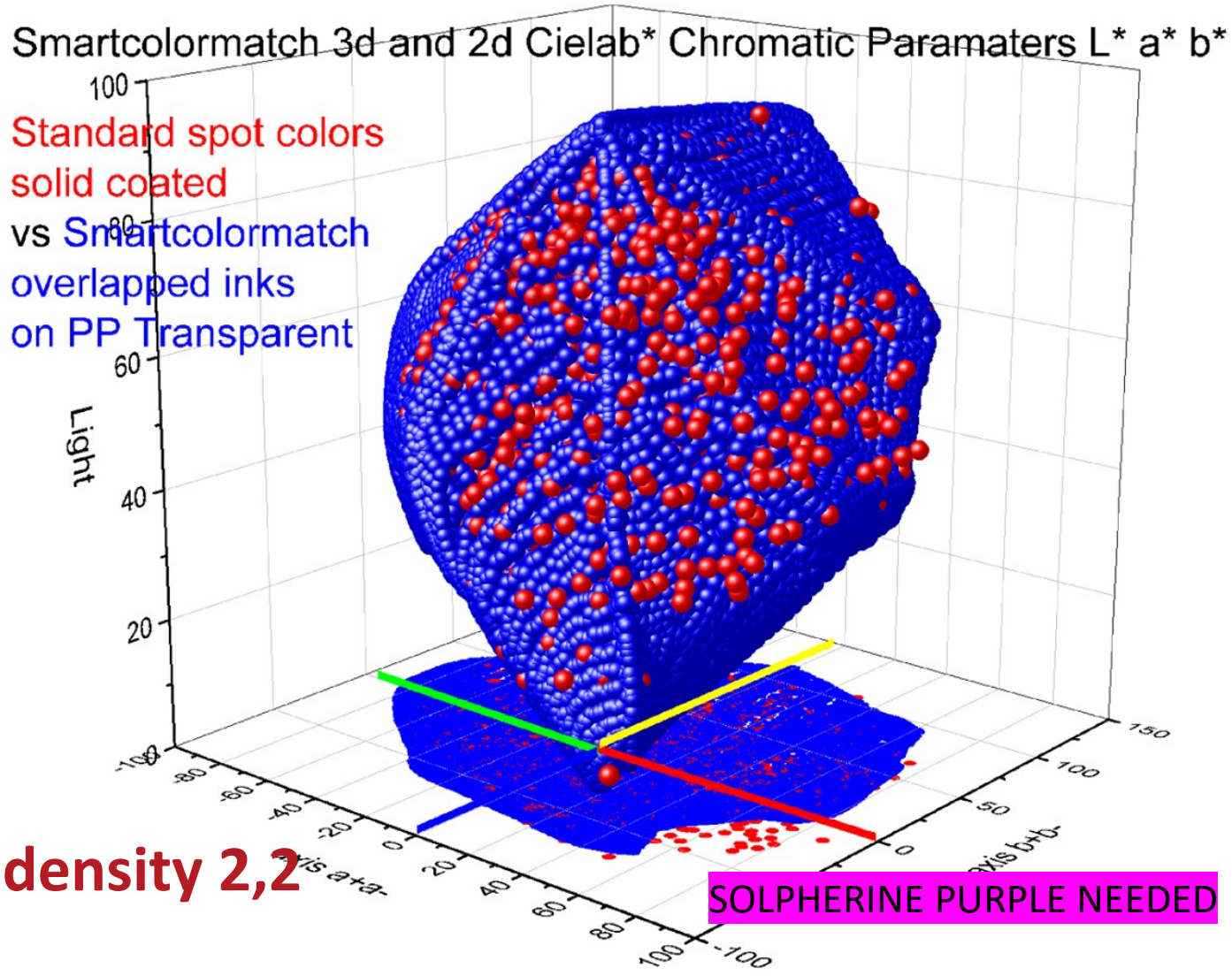



Smartcolormatch 3d and 2d Cielab* Chromatic Paramaters L* a* b*
100
80
60
40
20
Light


Smartcolormatch 3d and 2d Cielab* Chromatic Paramaters L* a* b*
Standard spot colors
solid coated
Light
axis a+a-
axis b+b-

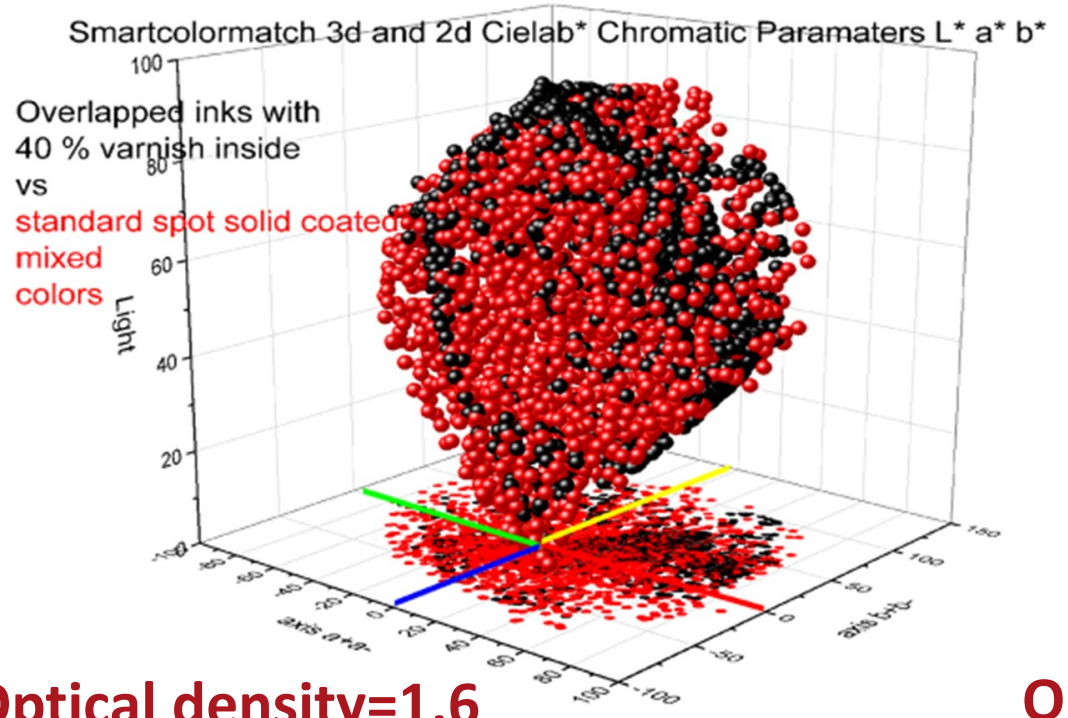


Average optical density 1,6

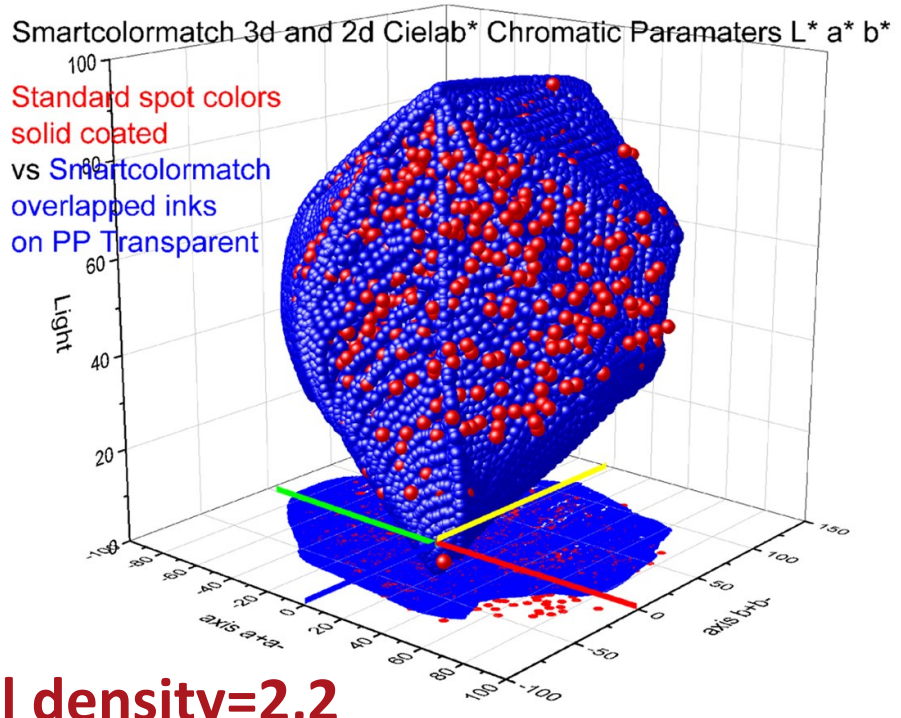


Average optical density 2,2

SOLPHERINE PURPLE NEEDED



Optical density=1.6



Optical density=2,2

Chromatic conclusions

1. If we reduce varnish into the ink at minimum possible with 2.2 average optical density, the gamut of heptachromy is wider (than 1.6 in quadrichromy used) and quite equivalent and inclusive to that of standard spot colors (Solpherine purple area excluded).
2. Better 60 lines than 70 lines for cilinders to satisfy a major amount of varnish requested and give more flexibility to printers.
3. To confirm results obtained, it will be necessary to print on a production rotogravure machine: ***work in progress***

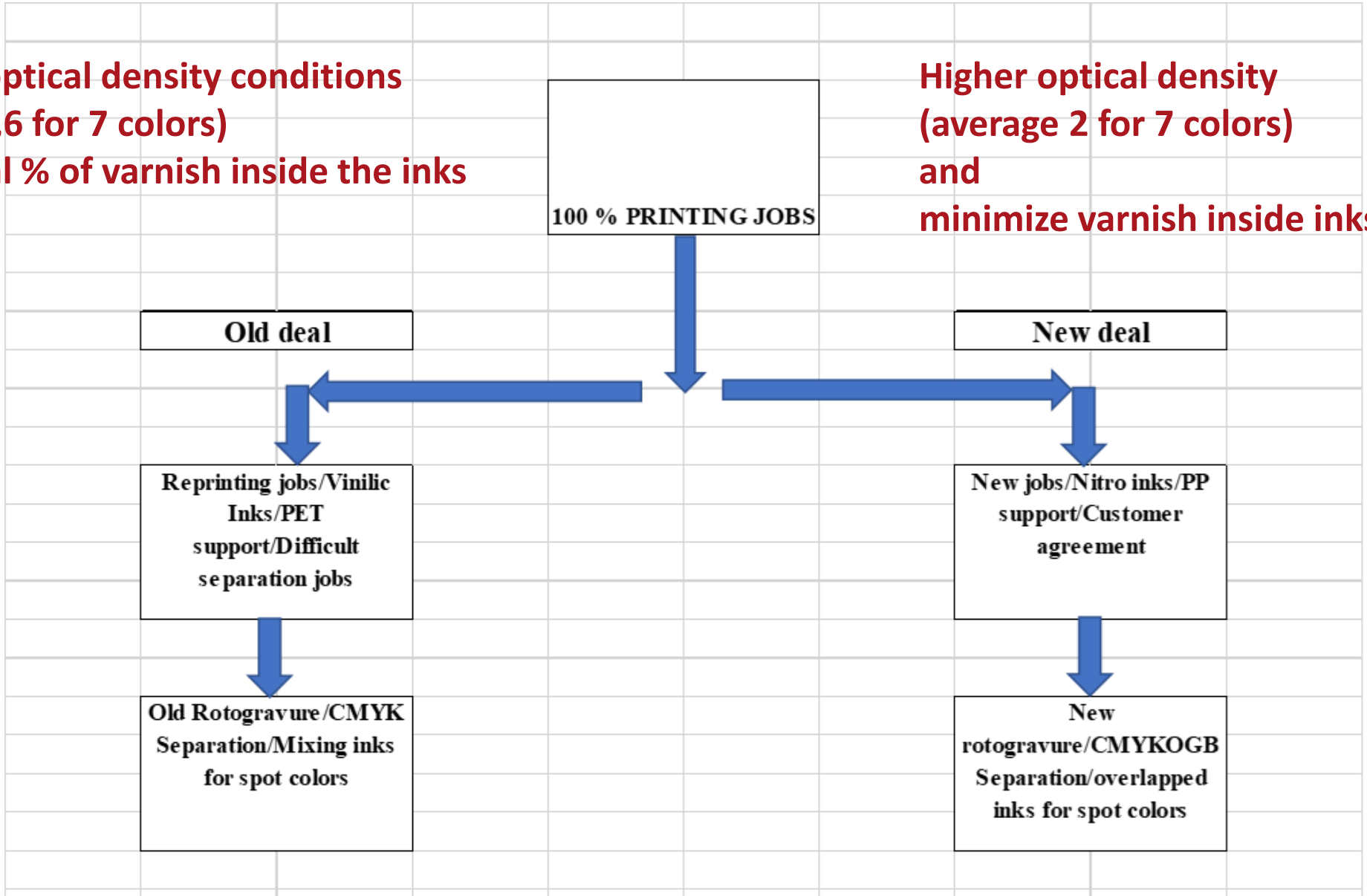
Some further suggestions on critical management aspects

1. **Minimize major raw material costs for double side print marks register necessity**
2. **Buy a new (or rewamp an old) rotogravure machine with a top-level double side register**
3. **Get customer's flexibility for changing color separations**
4. **Dedicate machine for external or internal print and not mix both**
5. **Organize and coordinate at top level graphic office inside and outside the company**
6. **Concentrate and train production people dedicated at the technology**

One possible way to manage at same time traditional and new printing method

Standard optical density conditions (average 1,6 for 7 colors) and normal % of varnish inside the inks

Higher optical density (average 2 for 7 colors) and minimize varnish inside inks



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Thank You!

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