Flexo plate dot shapes

Round, Flat, Why, When

FPPA 2012 Orlando FL
Ian Hole
ESKO

This session

A journey into the reasons why and when you should look at using different dot shapes will first take you to why Digital Flexo has changed the landscape forever and what some fine tuning can achieve from the basic technology.

Depending on your needs and market segment, plate imaging and press technology can make a difference to your printed result. This session will look at the best practices for ink types, substrates, presses and anilox rolls, based on the latest findings out there.

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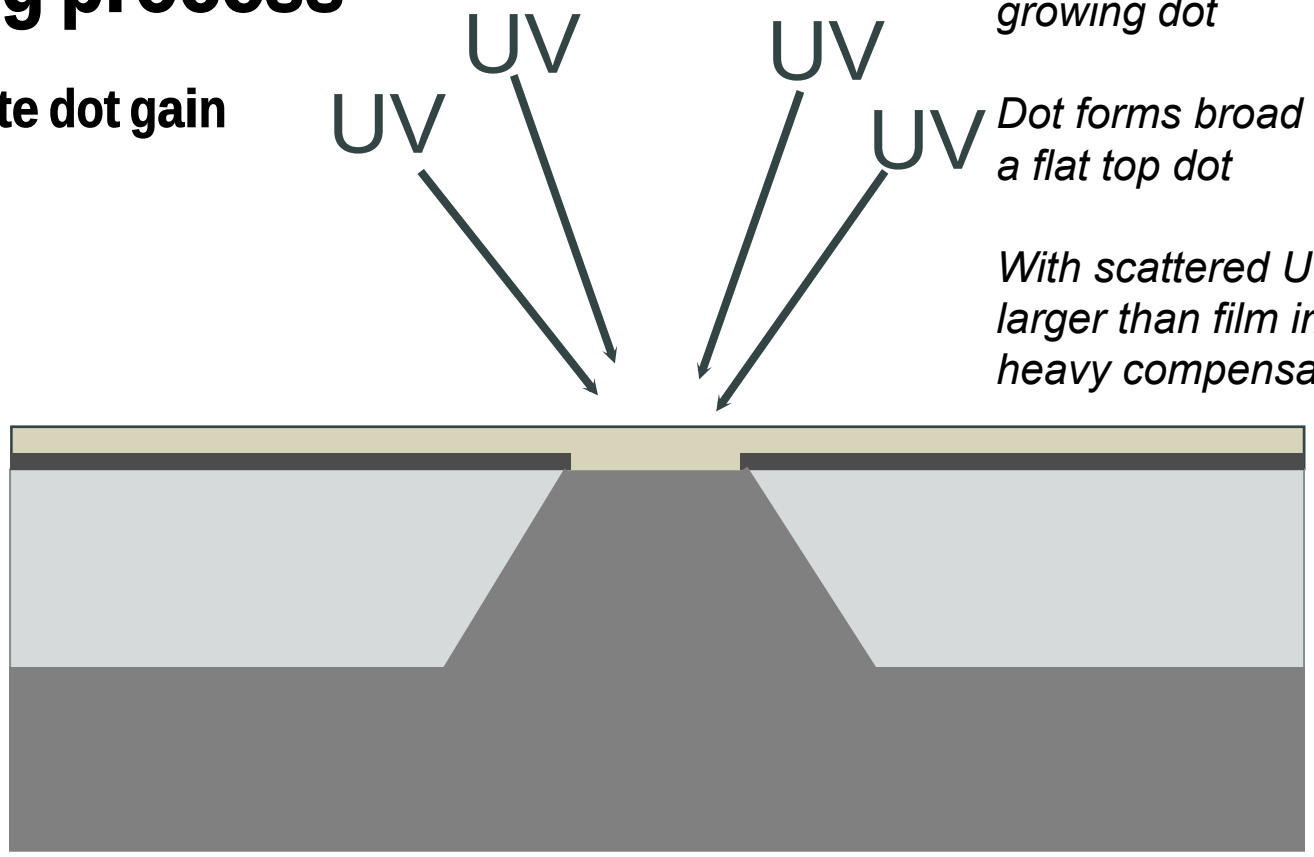
Pre 1993 - Film
Analog process

+ 15% plate dot gain



Analog plates in a vacuum with the a film image negative

Set the image using scattered UVA light resulting in a quickly growing dot

Dot forms broad shoulders and a flat top dot

With scattered UVA dot is 15% larger than film image requiring heavy compensation curves

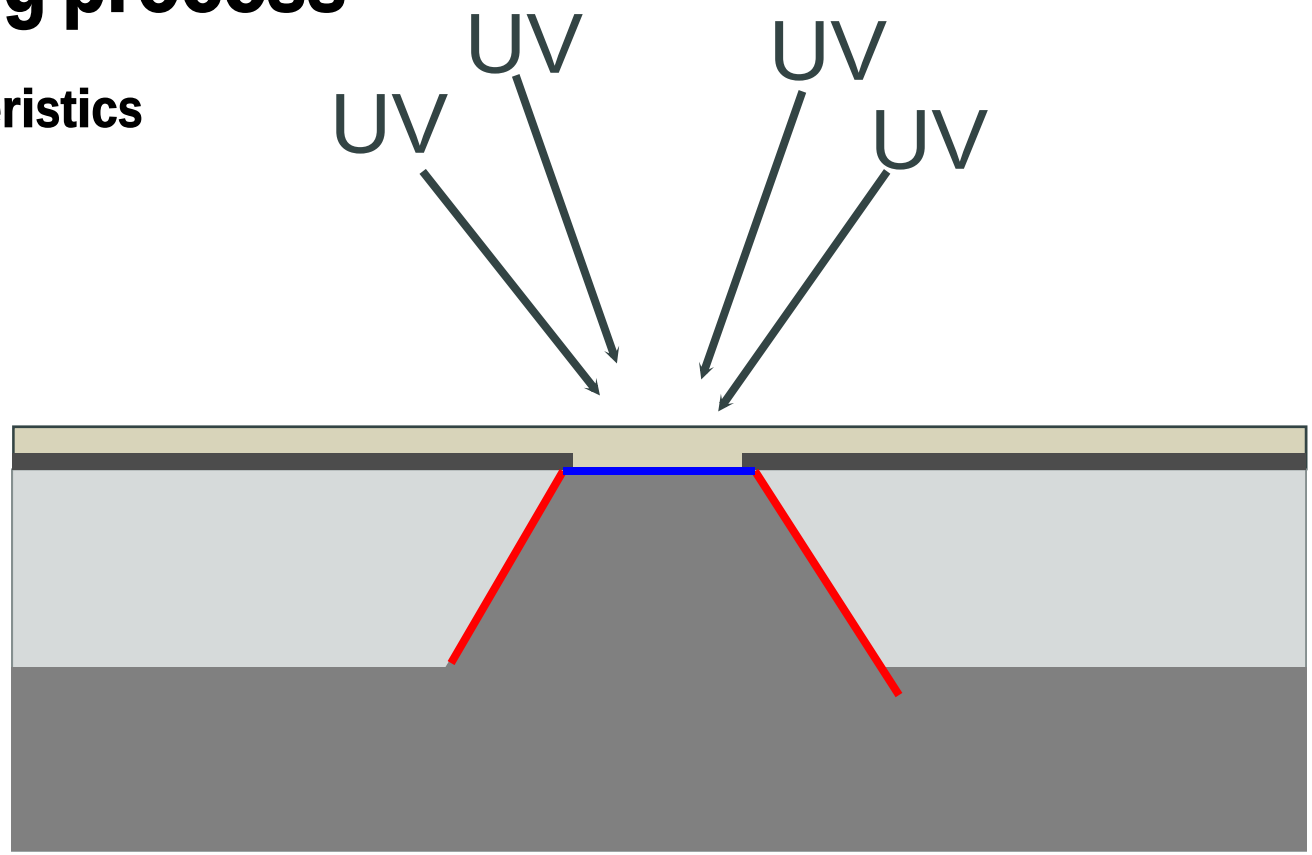
Pre 1993 - Film Analog process

Shoulder Angle is 45 – 55 degrees

Flat Top Dot

ONLY Solvent processing

Characteristics



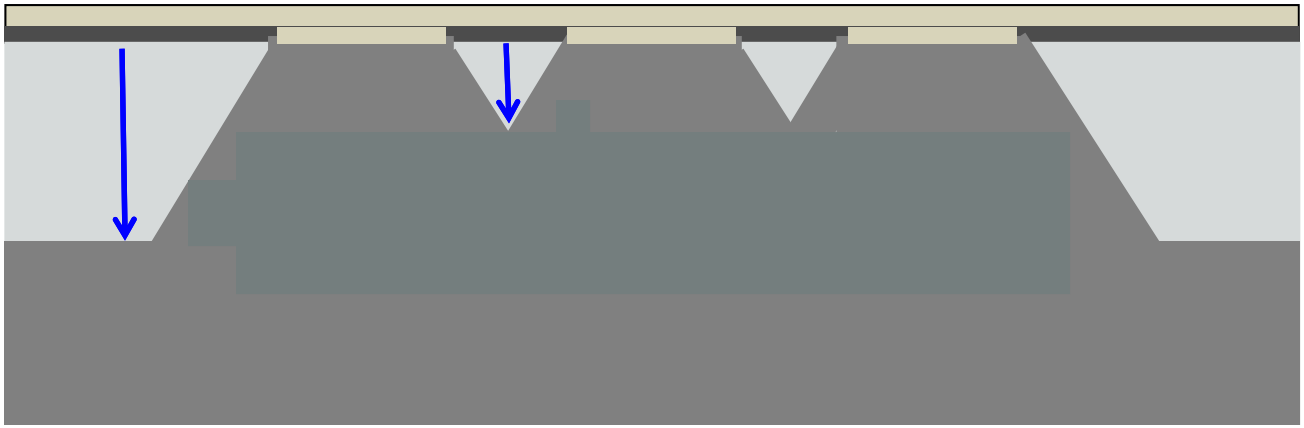
Pre 1993 - Film Analog process

Print Results

Shallow dot shoulders prevent plate floor depth if dots are too close to each other = low LPI

LPI is restricted dependent on the plate thickness
Corrugated 155/250 plates used 85 LPI
Flexible 107/112 plates used 120 LPI
Labels 067 plates used 150 LPI

045 & 030 plates not available



Pre 1993 - Film Analog process

Other Considerations

Minimum plate highlight dot restricted to approx. 3-5% by the film imaging resolution

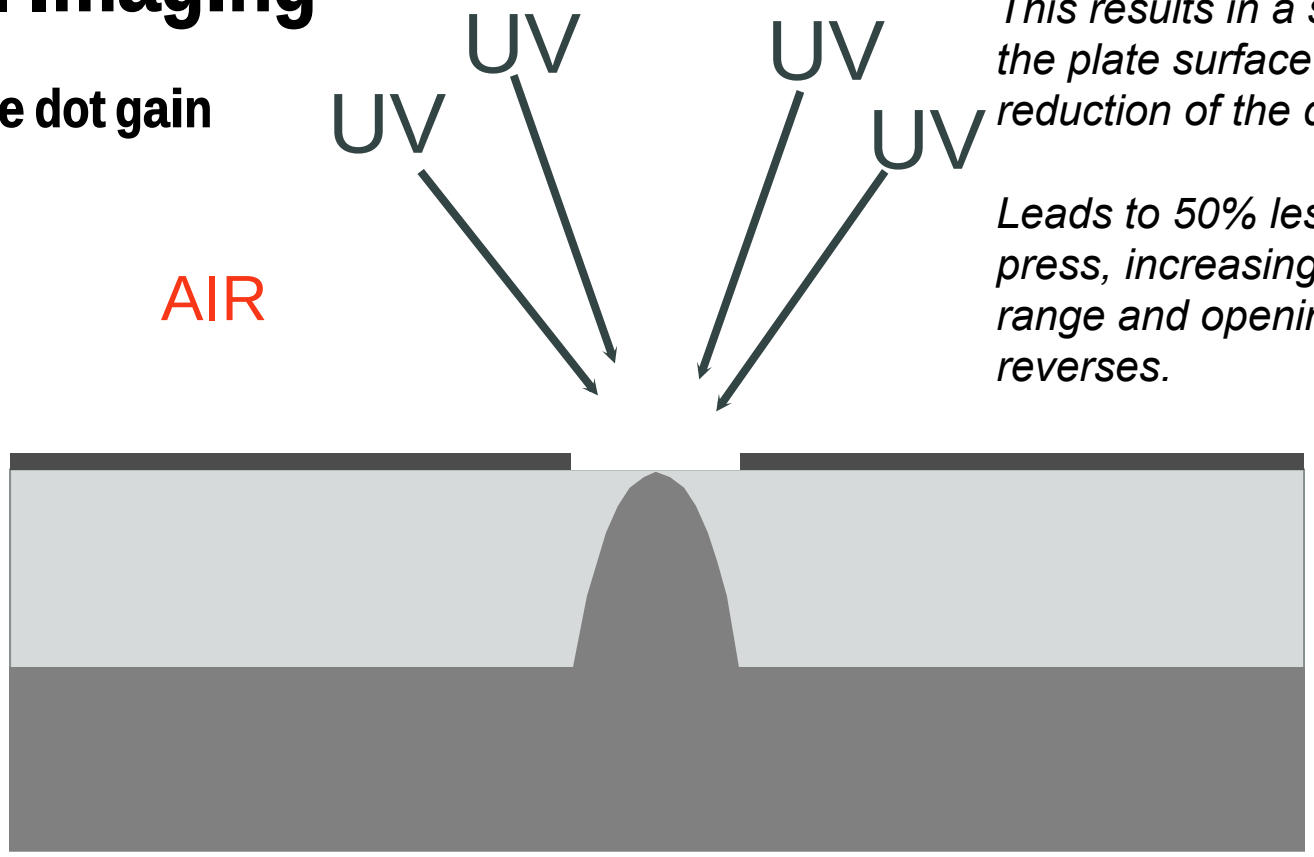
Shadow tones "filled in" due to limited plate relief Dot Gain a serious restriction when printing highlights and mid-tones

Flat Top print area produced "cupping" from cylinder size and mounting

1993 – today

Digital Imaging

- 15% plate dot gain



The "oxygen depletion effect" of standard digital plates slows down photo polymerization

This results in a smoothing of the plate surface AND a reduction of the dot size

Leads to 50% less dot gain on press, increasing the tonal range and opening up reverses.

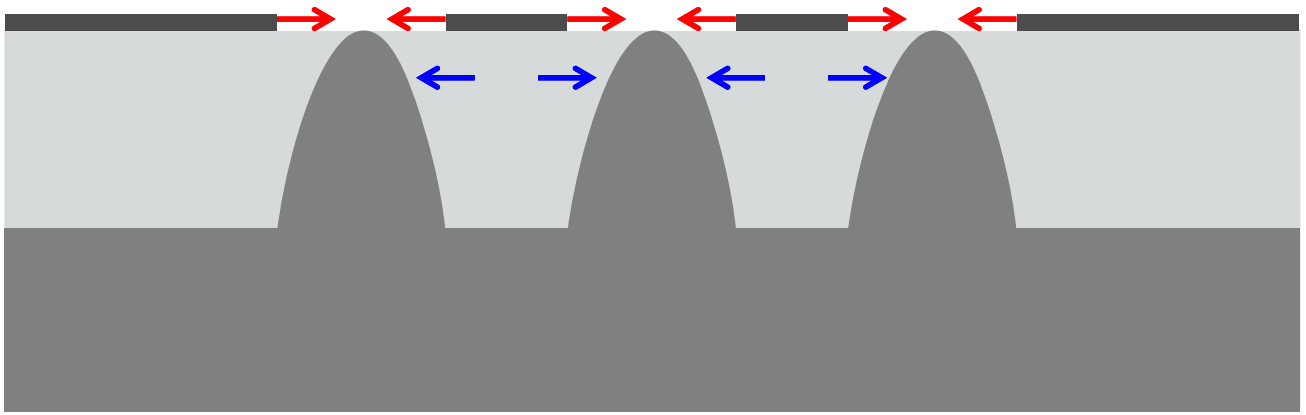
1993 – today

Digital Imaging

Print Results

Steep dot shoulders allows for greater plate floor depth even when dots are close to each other

LPI is NOT restricted by the plate thickness
Corrugated 155/250 plates uses 120/150 LPI
Flexible 107/112 plates uses 150/175 LPI
Labels 067 plates uses 200/250 LPI



1993 – today

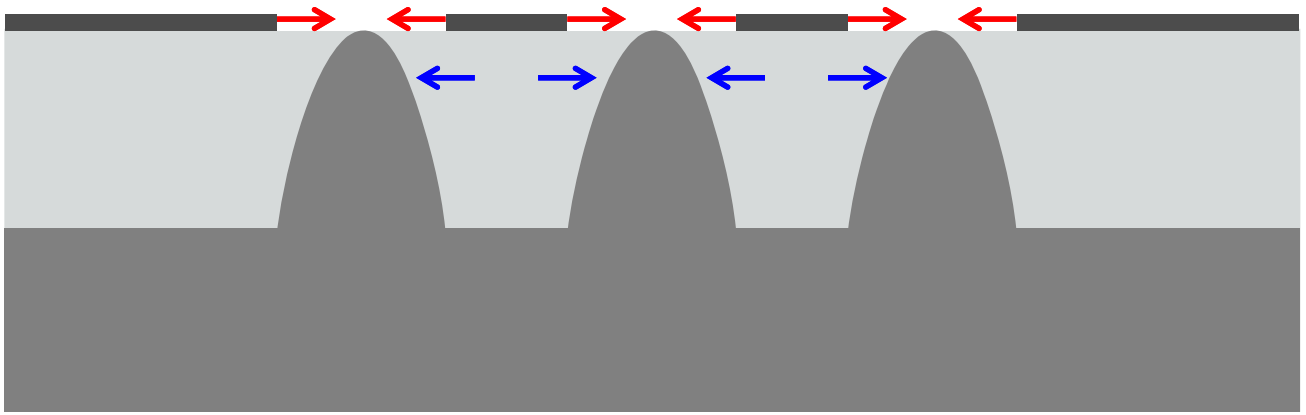
Digital Imaging

Other Considerations

New Plate types to strengthen the highlight dots with steep shoulders

Solvent, Water and Thermal Plate processing
Ink pigmentation stronger for fine highlight dots

Better image quality from better color control
Press control of impression improved
Press registration advanced



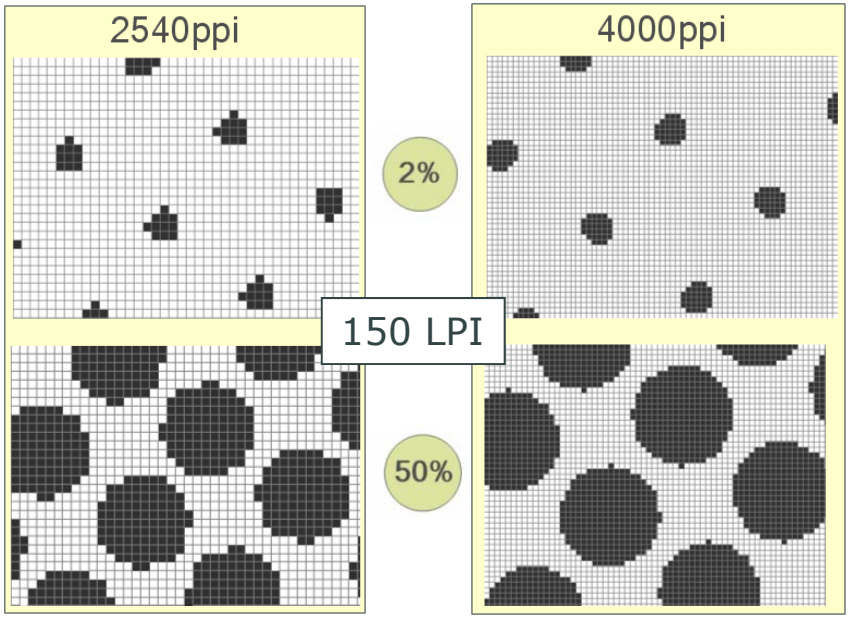
1993 – today

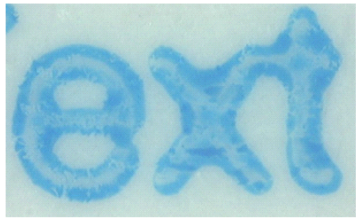
Digital Imaging

→ Small screening dots

→ Midtones and dot closure areas kept open

→ Text, Linework and Barcodes

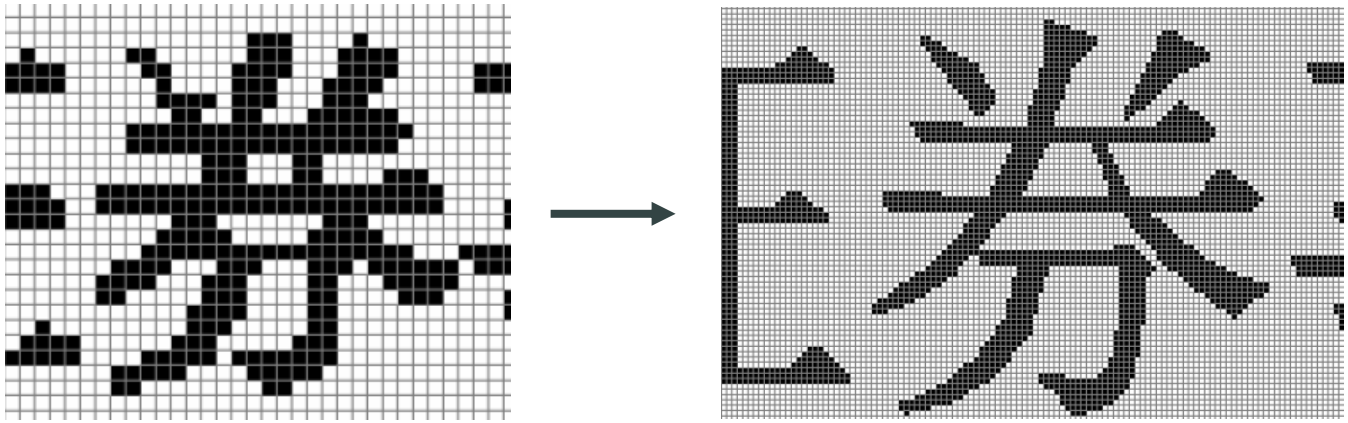


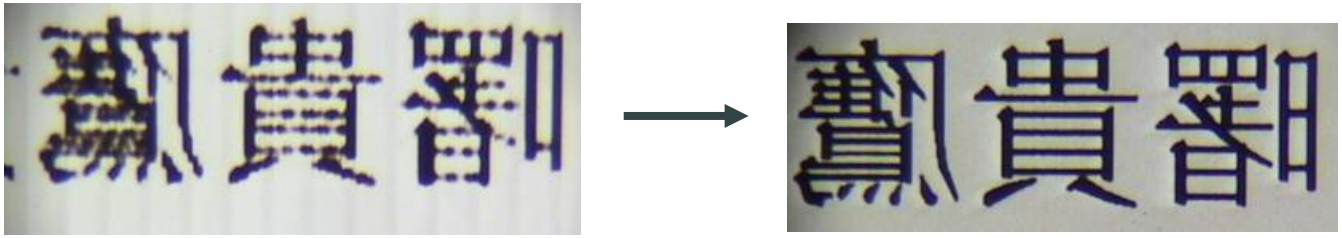


4pt 2540ppi

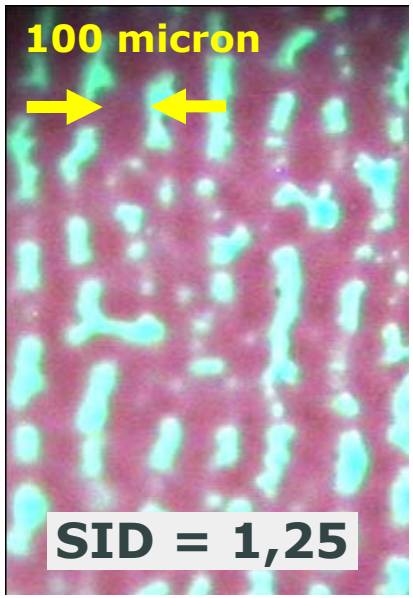
4pt 4000ppi

1993 – today - Digital Imaging – 2400 vs. 4000



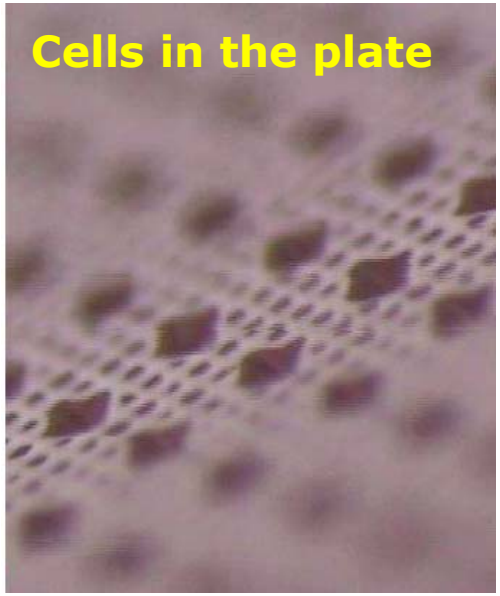


1993 – today – High Definition Imaging for Flexo



Solid print with standard plate surface (Solvent Ink)

Solid print with screening on plate surface

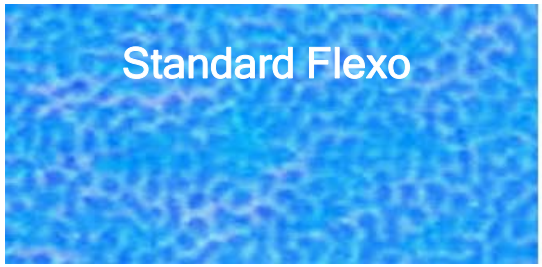


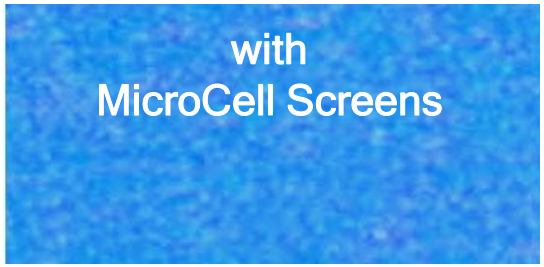
Cells 150 LPI = 650 LPI

1993 – today – High Definition Imaging for Flexo

- *Improved ink transfer due to plate screens*

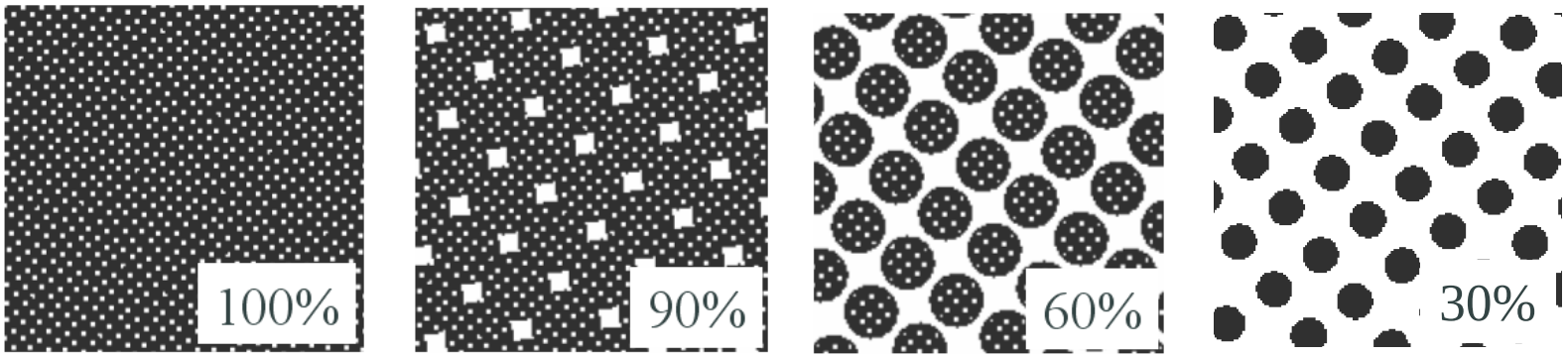
  → Reticulation patterns of the printing ink are destroyed = smooth ink laydown





- *HD Flexo delivers best compromise between good solids and color accuracy - FTA*
  - *Perfect solid appearance with only moderate SID increased (+0.1 … +0.2)*
    - *SID +0,1 → 25% more ink usage on press*
    - *SID +0,3 → 100% (!) more ink usage on press*
  - *Solids easily print inside ISO standards*
  - *Pantone inks can be emulated (< 3 ΔE) by using C,M,Y,K*

1993 – today – High Definition Imaging for Flexo

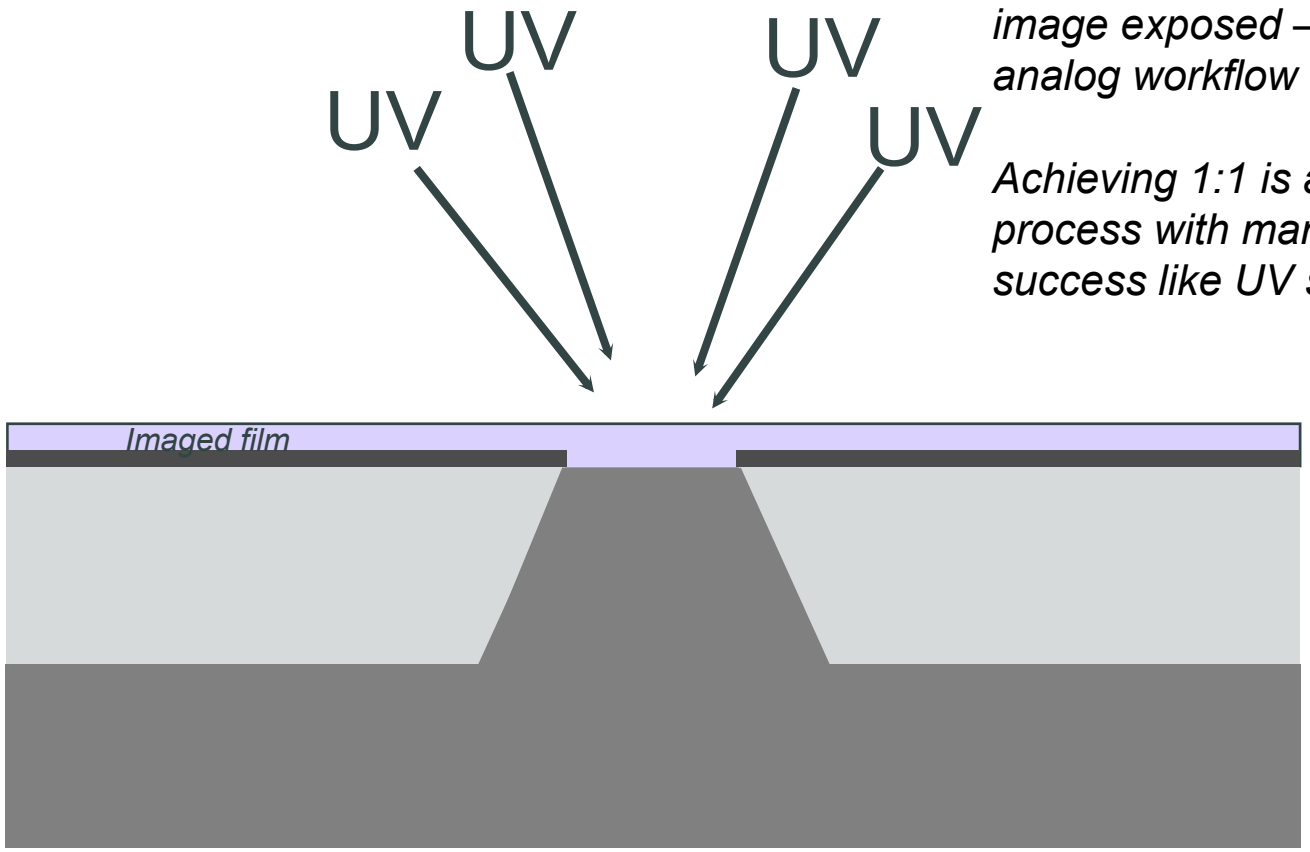


Screens are in the solids and screened dots

Finest structures are not destroyed

Fade out towards fine screening dots

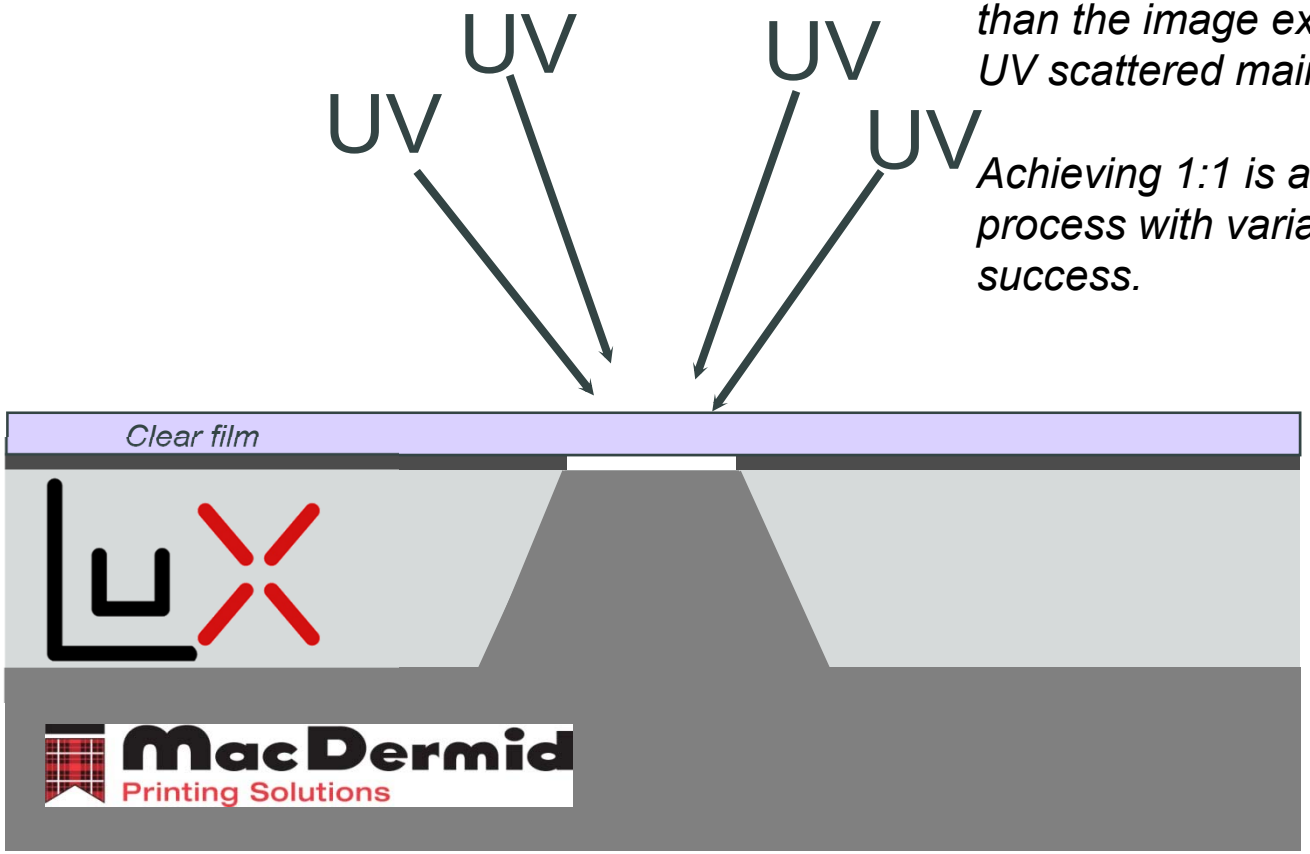
1993 – today - Film Imaging + Plate Lamination



Imaging technology producing a Flat Top dot onto a film then laminating film onto the plate surface restricts O_2 and makes a dot 1-3% bigger than the image exposed – this is an analog workflow

Achieving 1:1 is a critical process with many variables for success like UV scattered light

1993 – today – Plate Imaging + Film lamination



CTP digital dot then uses a film laminate to restrict O_2 at the plate surface

Makes a dot about 1% bigger than the image exposed due to UV scattered main exposure.

Achieving 1:1 is a critical process with variables for success.

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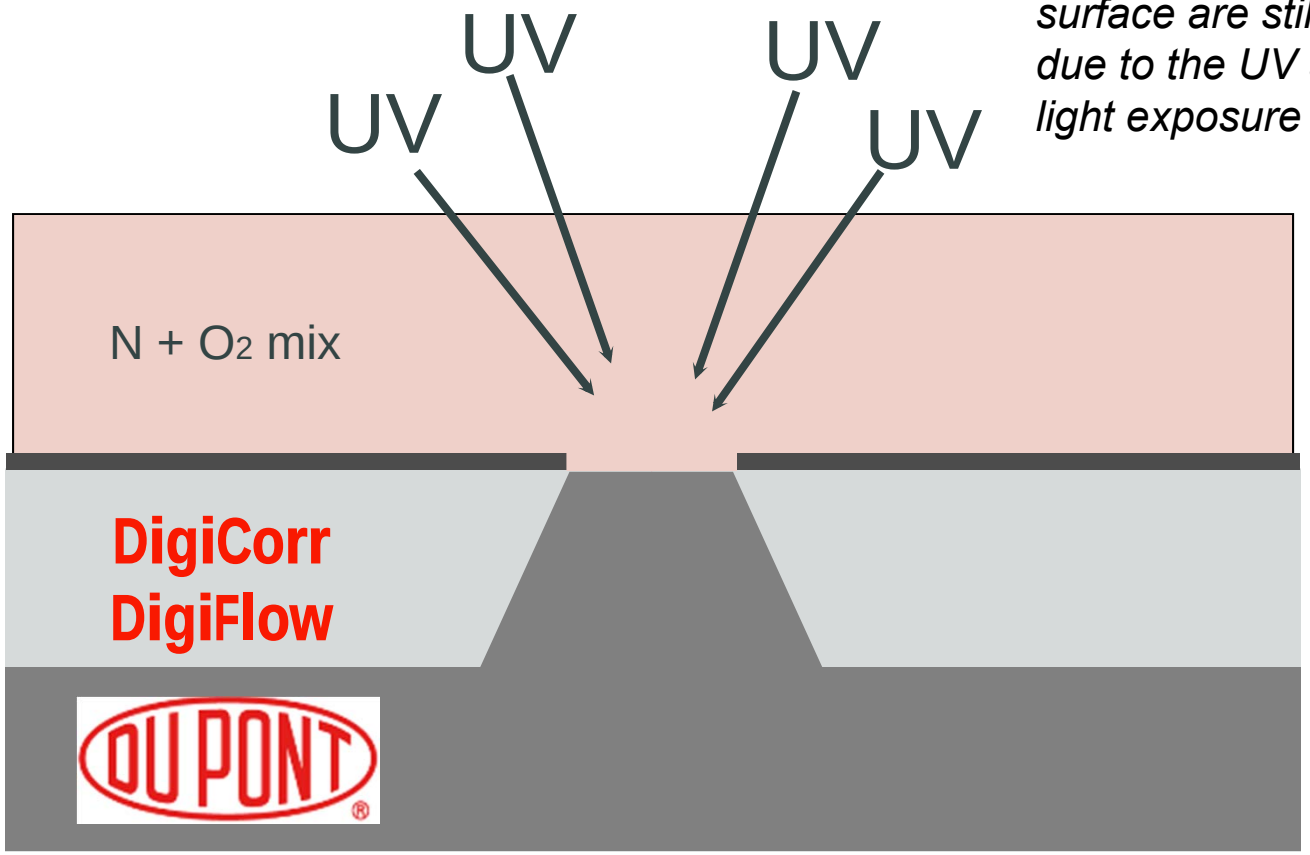
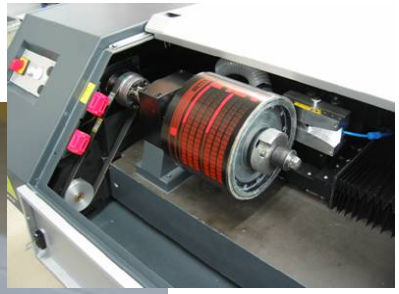
1993 – today - Plate Imaging + O_2 depletion

Exposing the plate in a controlled atmosphere

1:1 reproduction of image features on the plate surface are still variable due to the UV scattered light exposure



1993 – today - Plate Imaging for Beverage Cans & Plastic Containers



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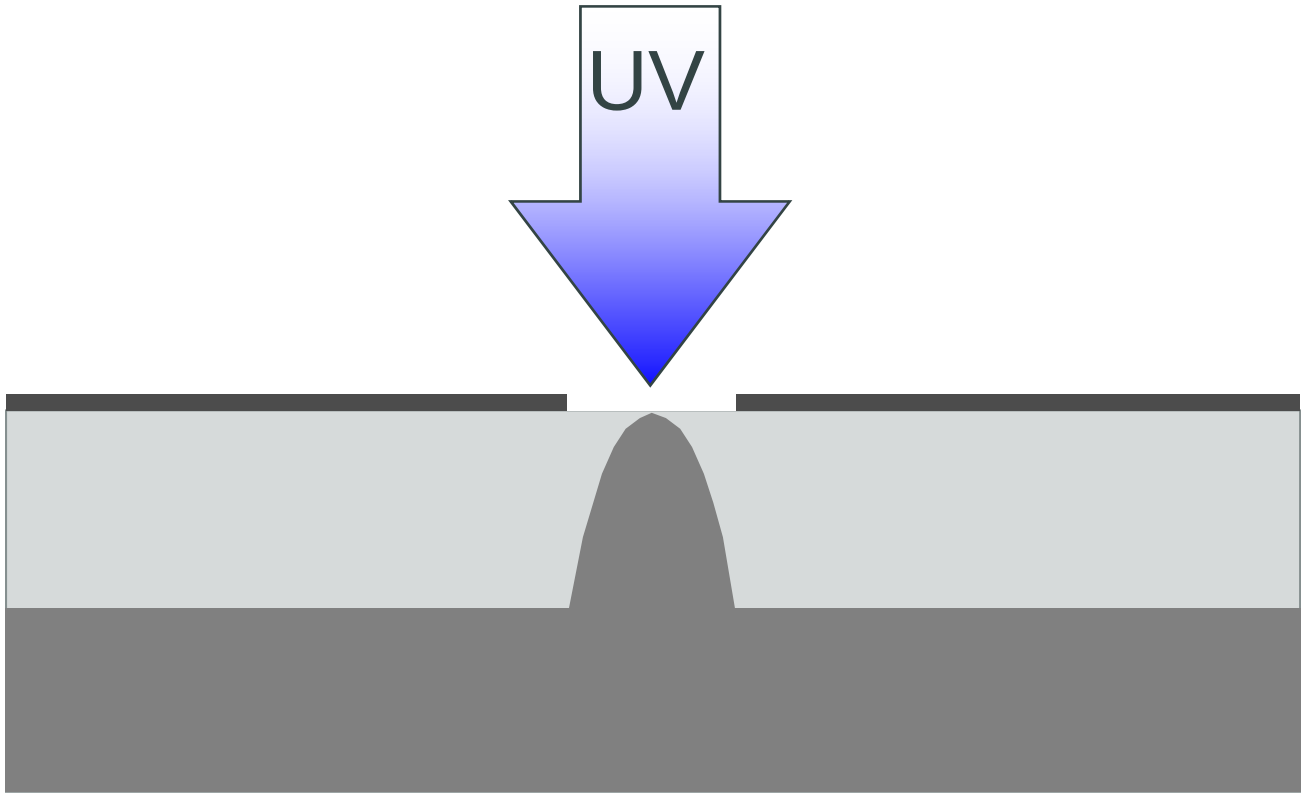
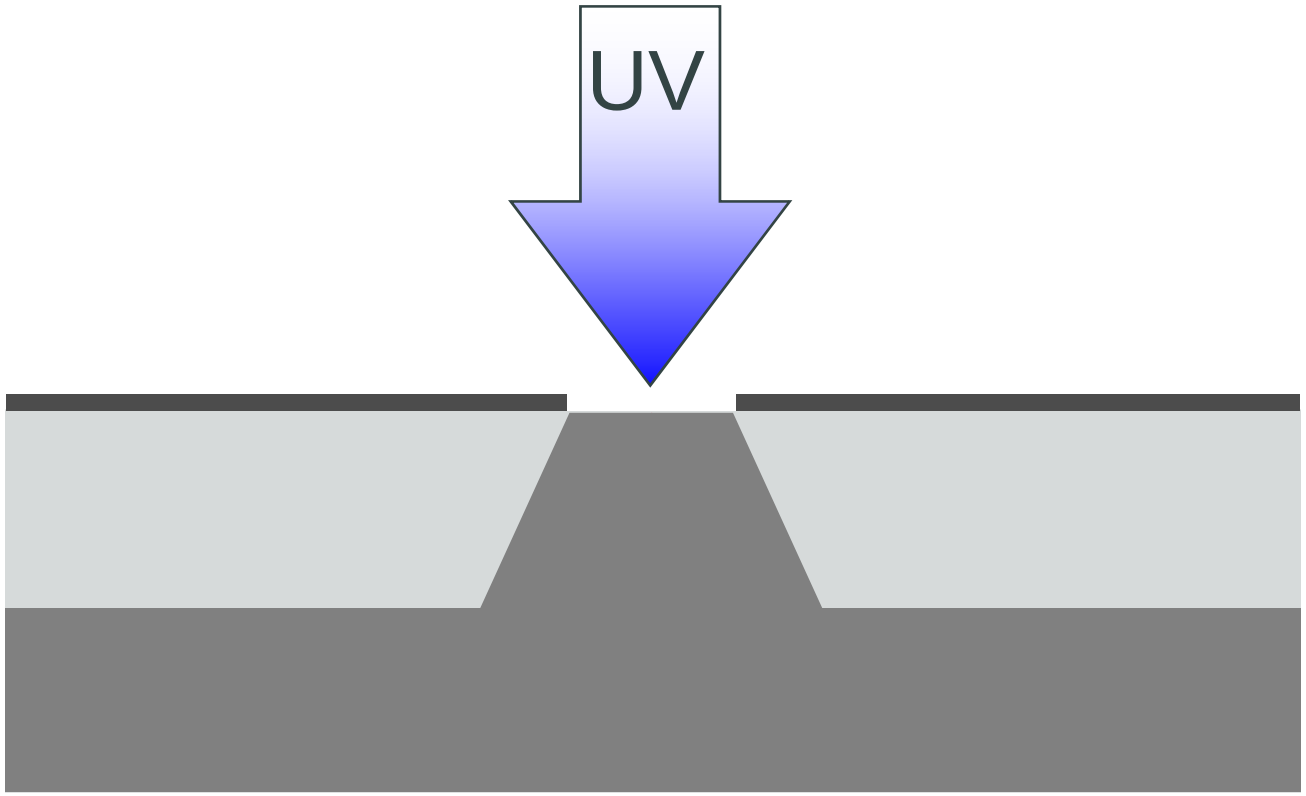
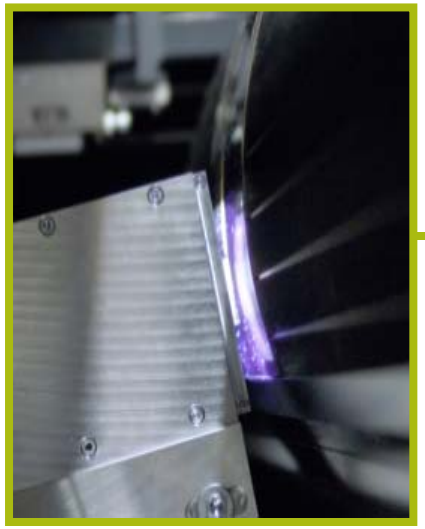
Digital Round Top process with calibrated UV main exposure – IUV2



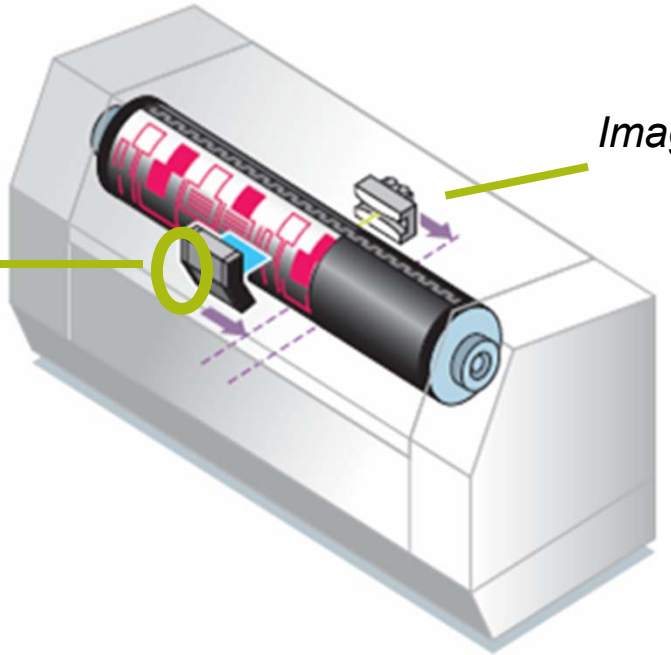
Digital Flat Top process with calibrated UV main exposure – IUV2

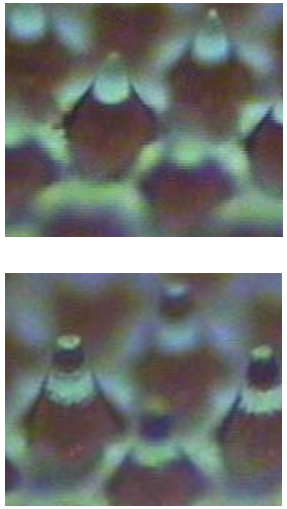


Digital Round or Flat Top process with calibrated UV main exposure – IUV2

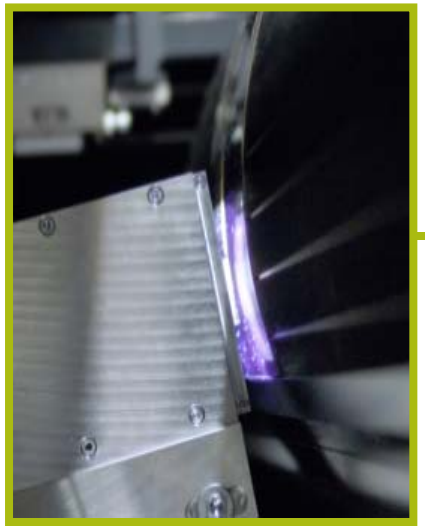


Digital UV Exposure

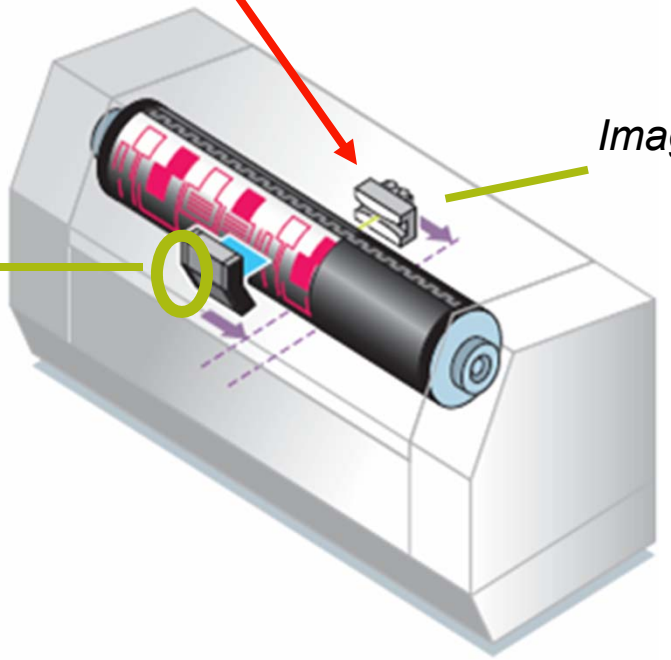


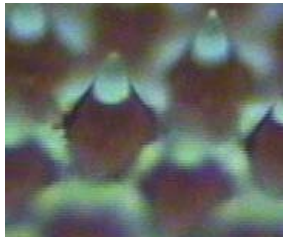


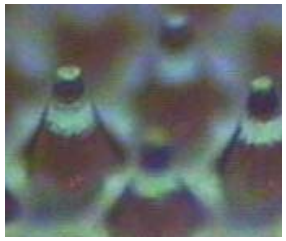
Digital Round or Flat Top process with calibrated UV main exposure – IUV2 with Pixel+ DRUPA



Digital UV Exposure







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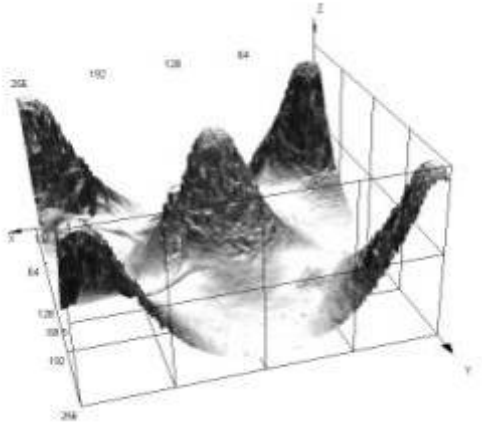
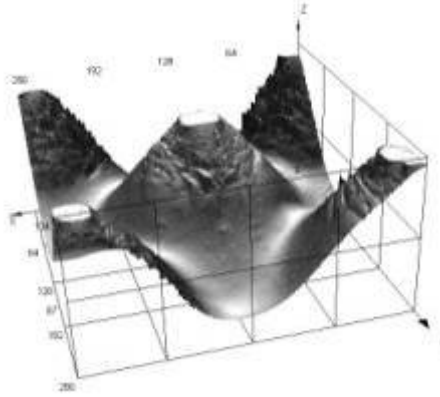
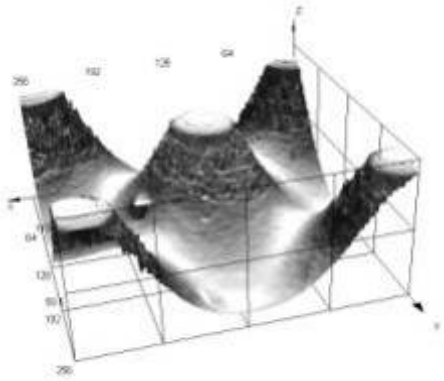
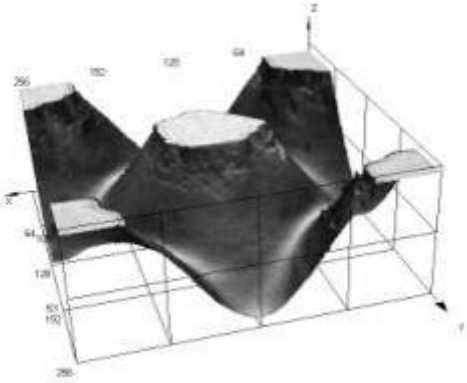
Dot shapes for every occasion









Fully Automatic Plate Imaging, UV main and back exposure - w/any dot shape

– plate ready for processing

48x35/ 42x60/50x80 plate sizes

Place plate onto steel top
Automatic feed in, loading, imaging, UV main exposure on drum
Unload plate for UV back exposure
Unload plate ready for processing

Sleeve and Plate Imaging, UV exposing – ready for processing

Easy-to-handle automated sleeve making

Fast sleeve exchange by automated tailstock and air support

More sleeves per hour

Summary so far

Digital Round and Flat Top dots *- choice by various methods on standard digital plates*

Round and Flat Top dots ***to get the best print results for every occasion***

Either Round or Flat top dots on a plate

Automatic Imaging, UV main and back exposure *to eliminate costs*

Industrial Sleeve and Plate production *a reality on 1 imager*

Inroads into traditionally non-Flexo markets – ***Cartons, Pre-print, Labels (all Offset)***

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A journey into the reasons why and when you should look at using different dot shapes will first take you to why Digital Flexo has changed the landscape forever and what some fine tuning can achieve from the basic technology.

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Generic Approved Set-ups
Labels – UV Inks

- Solvent, Thermal & Water based plates - **Round Top dots**
  - **Linecount:** 150lpi – 250lpi, **lower LPI not recommended**
  - **Anilox:** 950+ lpi for 150lpi, 1100 lpi for 175lpi, 1200+ for 250lpi
  - Anilox cell volume high enough to match SID targets
    - If SID not sufficient, **over-impression should not be used to increase SID**
  - **Specific plate types** have better solid and highlight qualities
  - **Softer plate types** have much lower highlight capabilities, but very good ink transfer (white, spot colors)
  - **Mottling can occur on paper label stock** with certain plates
  - **Mounting Tape** should be medium hard

Generic Approved Set-ups - Flexible Pkg – Solvent Inks

- Solvent, Thermal & Water based plates - **Round Top dots**
  - **Linecount:** 125lpi – 175lpi
    - HD screens for 133+ lpi
    - Circular screens or adapted HD screening for <133lpi
  - **Anilox per LPI:**
    - 850+ lpi for 124lpi
    - 900+ lpi for 133lpi
    - 950+ lpi for 150lpi (new types evolving)
    - 1100+ lpi for 175lpi (new types evolving)
  - Anilox cell volume should be between 2.2 bcm and 2.9 bcm
    - Lower bcm might deliver too low SID (even using high pigmented inks only)
  - **Microcells** create very smooth ink laydown, with variable to significant higher SID
  - **Specific plates** have better solid and highlight quality
  - Certain plates have much lower highlight capabilities, but very good ink transfer (white, spot colors)
  - **Mounting Tape** should be medium hard

Generic Approved Set-ups - Flexible Pkg – Solvent Inks

- Solvent, Thermal & Water based plates - **FlatTop dots**
  - **Linecount:** 133lpi – 175lpi
    - HD screens for 150+ lpi, Circular screens for 133 - 150lpi
  - **Anilox**
    - CMYK with < 2.2 bcm and > 1150 lpi mandatory for good highlights Higher ink densities on suitable inks (SID +0.2...+0.3 on top of standard solids)
    - Anilox volume > 2,2 bcm - Limited highlight capabilities, but extreme ink densities achievable (SID +0.3...+0.8)
    - White gives significant opacity increase (use high-frequency MicroCells)
    - Spot colors - Significant ink laydown improvement for Anilox volume < 3.5 bcm in combination with higher LPI (133lpi/150lpi) possible, depends on ink type
  - **Mounting tape**: Use medium soft

Generic Approved Set-ups - Flexible Pkg – Water based Inks

- Solvent, Thermal & Water based plates - **Round Top dot shape**
  - **Linecount:** 124lpi – 175lpi
    - HD screens for 133+ lpi
    - Circular screens or adapted HD screening for <133lpi
    - For >133lpi we highly recommend attention to ink buildup problems that might occur
  - **Anilox LPI:**
    - 850+ lpi for 124lpi
    - 900+ lpi for 133lpi
    - 950+ lpi for 150lpi
    - 1000+ lpi for 175lpi
  - **Anilox cell volume** should be between 2.2 bcm and 2.9 bcm
  - **Microcells** improve ink laydown smoothness
    - Hides paper structure (less mottling)
    - But no increase in SID (max. +0.05)

Generic Approved Set-ups – Corrugated Preprint – Water based Inks

- Solvent, Thermal & Water based plates **- Round Top dot shape**
  - **Linecount:** 133lpi – 175lpi, **lower LPI not recommended in Europe**
  - **Anilox:** 800+ lpi for 133lpi, 900+ lpi for 150lpi, 1000+ lpi for 175lpi
  - **Anilox cell volume** should be between 2.2 - 2.8 bcm
  - **Microcells** can smooth solid printout, but does not create higher SID
  - **Some plates** deliver very good ink transfer **BUT are insensitive to fluting**
  - **Plate thickness should not exceed 0.155**
    - 0.250 will restrict highlight capabilities
  - **High Definition screens**
    - Increase tonal range
    - Transitions to zero

Generic Approved Set-ups – Corrugated Postprint

- Solvent, Thermal & Water based plates **– Flat Top dot shape**
  - **Linecount:** 133lpi – 175lpi - **lower LPI not recommended in Europe**
  - **Anilox:** 800+ lpi for 133lpi, 900+ lpi for 150lpi, 1000+ lpi for 175lpi
  - **Anilox cell volume** mandatory between 2.4 – 3.2 bcm
  - **Microcells** smooth solid printout and **increase higher SID**
  - **Some plates** deliver very good ink transfer **eliminate fluting**
  - **Plate thickness should not exceed 0.155**
    - 0.250 may lower highlight capabilities
  - **High Definition screens**
    - Increase tonal range
    - Transitions to zero
  - **Calibrations differ per substrate** – Virgin, recycled, single, double & multi-walled
- Quality Corrugated in Europe uses higher specs than NA

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Summary - Higher quality - demands more critical set-ups

- **Take your basic factors -**
  - **Substrate, Ink types, Press….**
- **Choose your variables**
  - **Linecount** – there are limitations for lower and higher LPI
  - **Anilox** – now becomes part of the choices
  - **Anilox cell volume -** will determine the tonal range
  - **Plate type –** dot shapes will require certain plates
  - **Microcells** will smooth ink laydown and create a higher SID
  - **Some plates** deliver very good ink transfer **BUT are insensitive to fluting**
  - **Plate thickness** – for corrugated this is a critical factor for quality
  - **Mounting tapes –** critical factor with different dot shapes
  - **High Definition screens and cells** – choices to be made

HD-Flexo Data Sheet

Anglesets

	Flexo 1	Flexo 2	Offset
Y	7,5	82,5	0
M	52,5	37,5	75
C	22,5	7,5	15
K	82,5	67,5	45

Anilox ruling

Anilox l/cm	Anilox lpi	Print max lpi	Print max l/cm
250	620	99	39
270	680	112	44
300	750	124	48
320	800	136	54
340	870	136	54
360	900	150	60
400	1000	161	63
420	1070	175	70
480	1220	200	80

1 l/cm = 2,54 lpi

$LPI_{max}=LPI_{anilox}$ / 6

Viscosity

Zahn 2mm 48ccm	DIN Frikmar 4mm 100ccm	DIN Erichsen 3mm 100ccm	AFNOR 4mm 100ccm
14	10	19	11
17	12	24	16
17	13	25	16
17	13	26	16
17	13	26	16
18	14	28	17
19	14	29	18
19	15	31	18
21	16	34	20
22	17	38	21
23	18	40	22
25	19	42	23
27	20	46	25
28	22	52	27

Mounting Tape

foam	3M	Lohmann	Tesa	Rogers
very soft	11xx		xxx23	
soft	19xx	x.1	xxx22	21xx, 31xx
medium soft	13xx	x.2		
medium	10xx		xxx21	23xx, 33xx,
medium firm	15xx	x.3		
firm	17xx	x.4	xxx20	25xx, 35xx
very firm	18xx			

Anilox Volume

BCM	cm³/m²
1	1,6
1,3	2,0
1,6	2,5
1,9	2,9
2	3,1
2,2	3,4
2,3	3,6
2,5	3,9
2,6	4,0
2,8	4,3
2,9	4,5
3,1	4,8
3,4	5,3
3,7	5,7
4	6,2
4,3	6,7
4,6	7,1
4,9	7,6
5,2	8,1
5,5	8,5

1BCM=1,55 cm³/m²

NoDGC Lettercode

Letter	Bump %
C	0,3
D	0,7
E	1,1
F	1,5
G	1,9
H	2,3
I	2,7
J	3,1
K	3,5
L	3,9
M	4,3
N	4,7
O	5,1
P	5,5
Q	5,8
R	6,2
S	6,6
T	7,0
U	7,4
V	7,8

LV-MV recommendation

Anilox Ruling Volume	< 360 L/cm < 900 LPI	> 360 L/cm > 900 LPI
> 4,5 cm³/m² > 3 BCM	MV mandatory	MV recom. LV possible
< 4,5 cm³/m² < 3 BCM	MV recom. LV possible	LV recom.

Summary - Higher quality - demands more critical set-ups

ESKO

Summary - Higher quality - demands more critical set-ups

- There is a correct way to achieve what you want BUT you must follow strict process parameters
  - With 1 time set-ups for all your print circumstances you can predict & expect good results
  - (FULL version of Approved set-ups available)
- The NON-techical viewpoint on dot shapes is -
  - Digital Round Tops almost always gives a good result
    - Especially in highlights and drop shadows
  - Digital Flat Tops work for specific applications
    - Postprint on poor board – the most obvious
    - Thin substrate Wide web Flexible
- **WELCOME to the world of quality Flexo !**

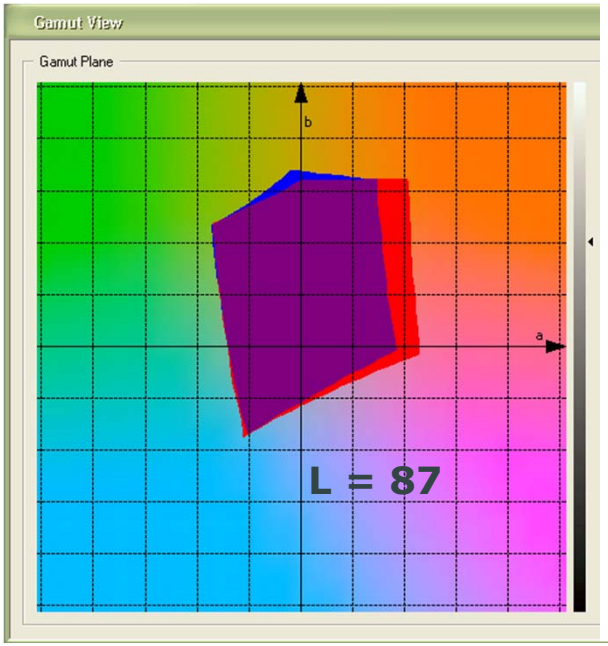
ESKO

Higher quality - demands more critical set-ups – the BENEFITS

- Ability to print almost anything at high quality brings
  - Greater competitiveness against others
  - Takes market share from Offset - increasing Flexo
  - Complete solutions for supply chain owners
  - Brand satisfaction
  - Better color.....
- Extended Gamut 7
  - CMYK+OGB gives +95% of all pantone colors – PANTONE LIVE
  - Accurate color matches
  - Saves ink, plates, substrate and press time
  - Saves money and cuts costs

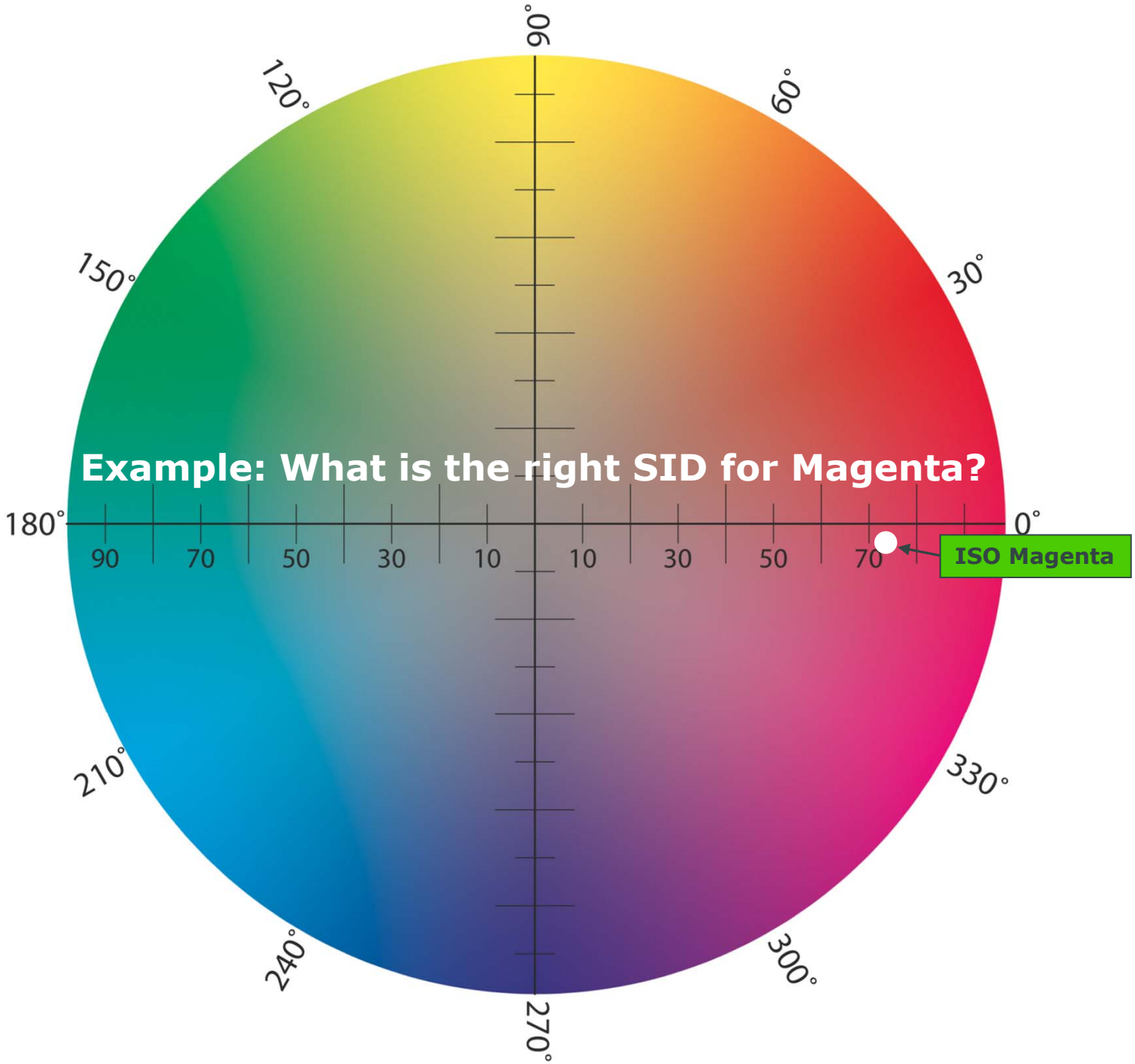
ESKO

Future – High resolution plates bring Extended Gamut Color consistency

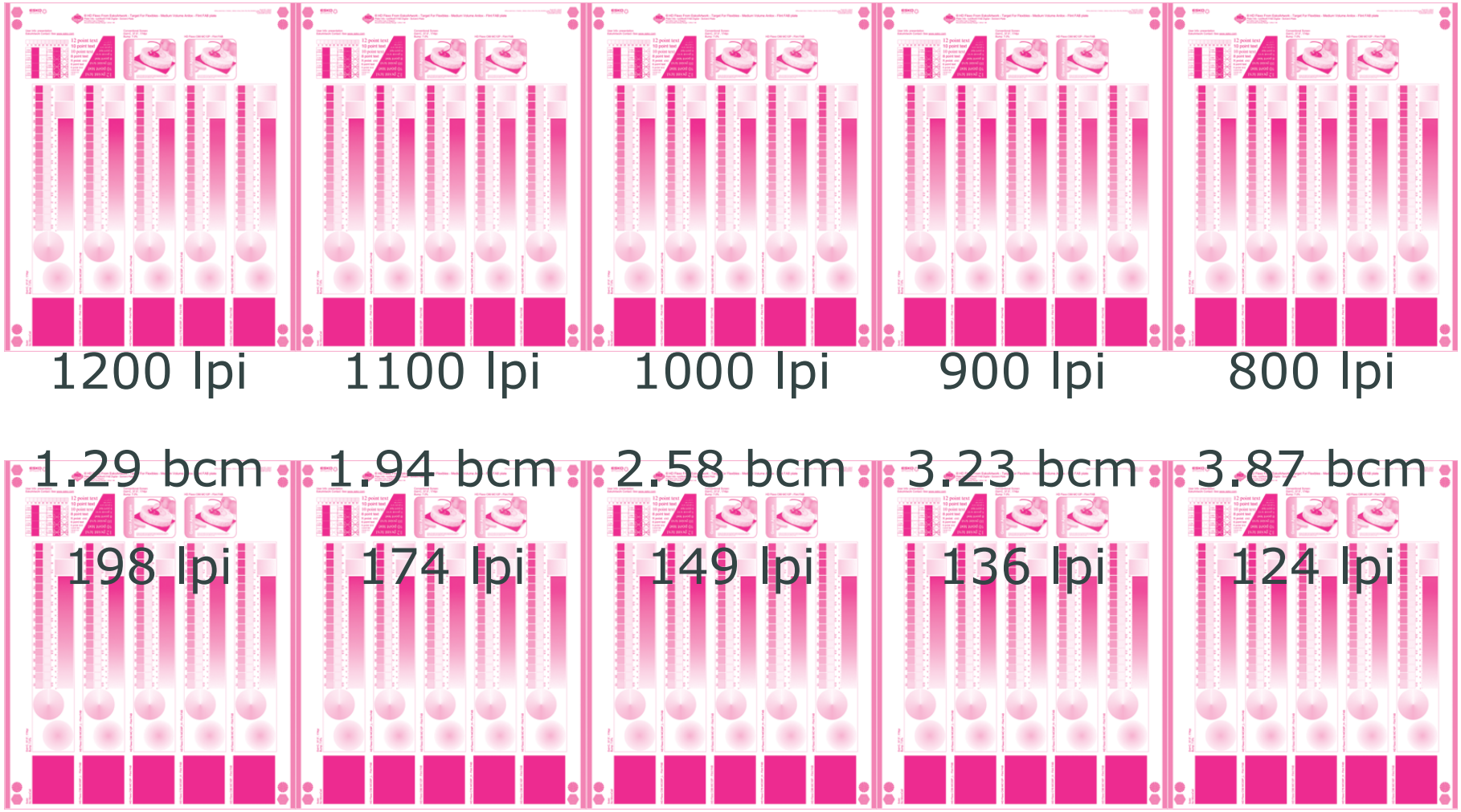


Smooth solids <u>and</u> good highlights - extend printable color space:

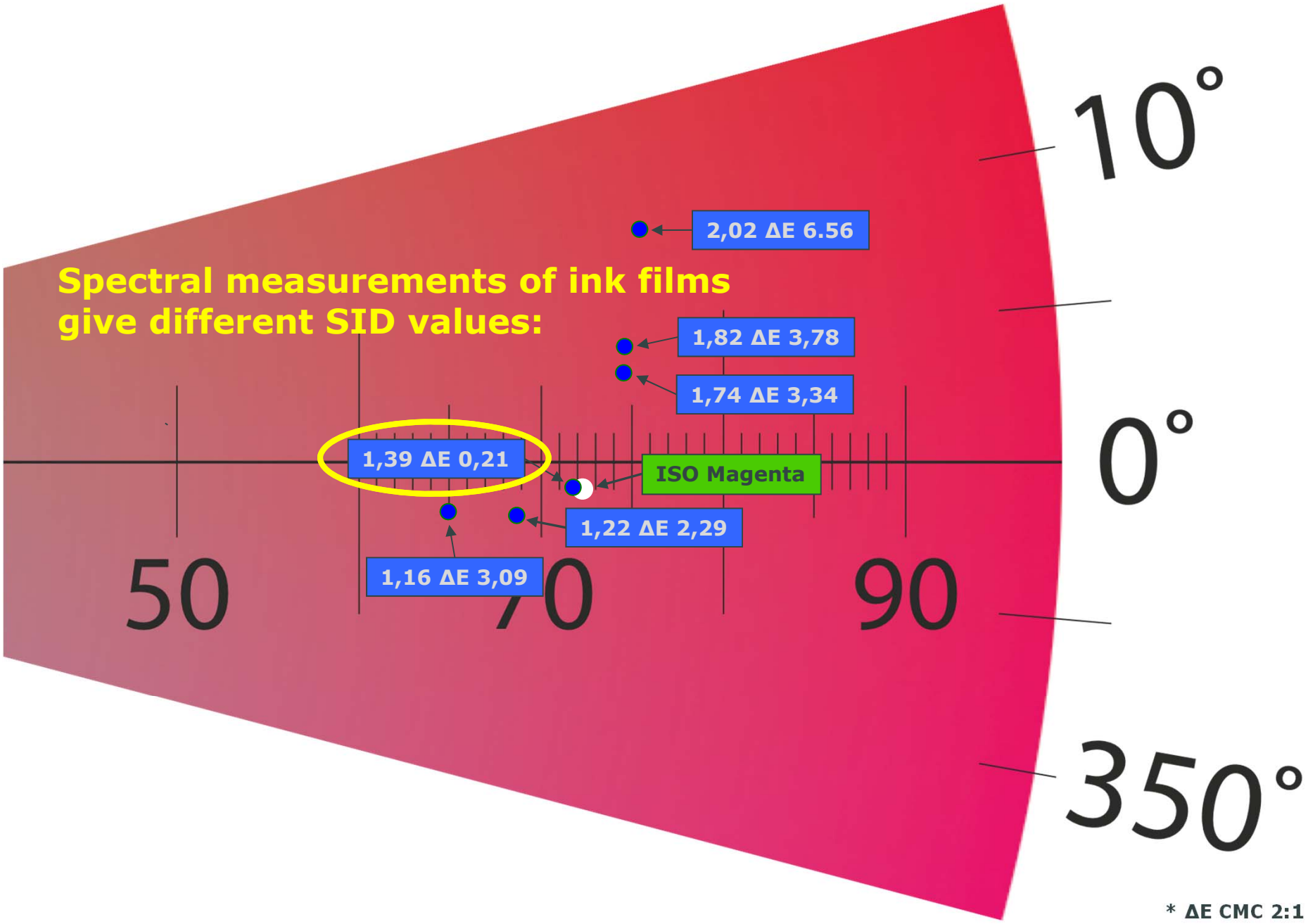
- *Over 95% of all pantones can be emulated on typical Flexible Packaging presses by using only C,M,Y,K inks (Accuracy < 3 ΔE)*
- *Most of remaining 5% most can be emulated using C,M,Y,K,O,G,B inks*


Example: What is the right SID for Magenta?
90°
120°
60°
150°
30°
180°
0°
210°
330°
240°
300°
270°
90
70
50
30
10
10
30
50
70
ISO Magenta

Test Form – Print Specs

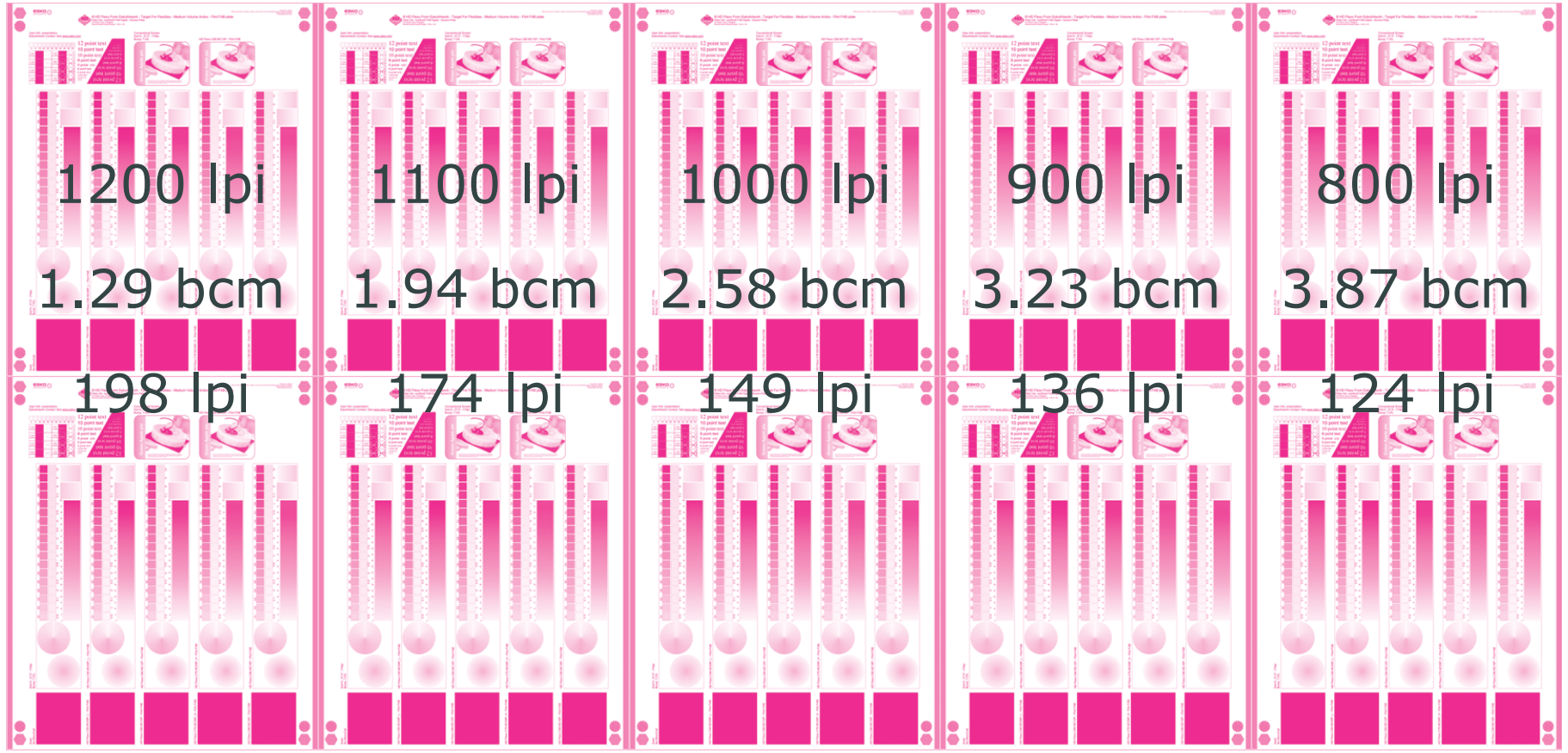


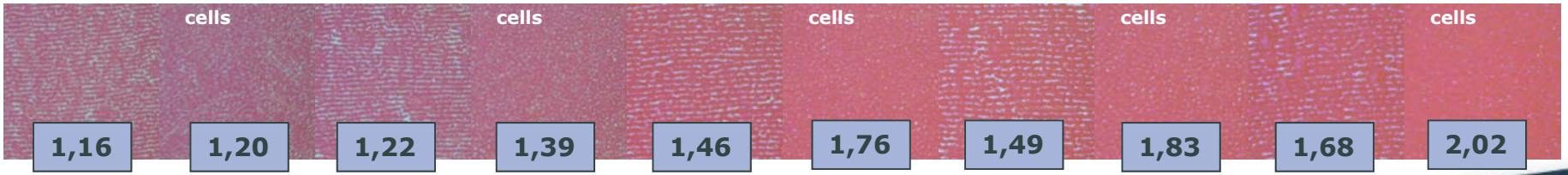
1200 lpi	1100 lpi	1000 lpi	900 lpi	800 lpi
1.29 bcm	1.94 bcm	2.58 bcm	3.23 bcm	3.87 bcm
198 lpi	174 lpi	149 lpi	136 lpi	124 lpi


Spectral measurements of ink films
give different SID values:
2,02 ΔE 6.56
1,82 ΔE 3,78
1,74 ΔE 3,34
1,39 ΔE 0,21
ISO Magenta
1,22 ΔE 2,29
1,16 ΔE 3,09
10°
0°
350°
50
70
90

* ΔE CMC 2:1

Test Form – SID & Cell results



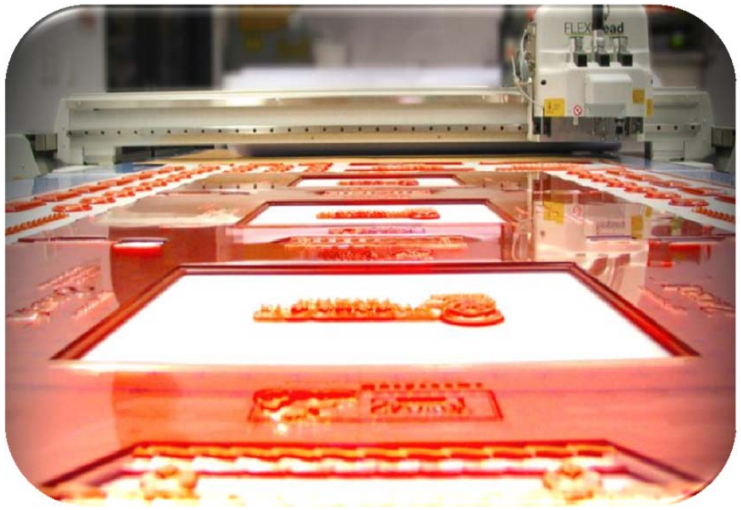


Future – Gamut Color expansion in images

Thank You

ian.hole@esko.com

Software creates Digital iMask for Liquid plates



- **"iMask"** is a software option to generate Liquid i-Plates
  - Requires an inkjet film output device (from plate vendor) OR
  - Output of dry film on CDI
  - Outputs a TIFF file format

- **Benefits:**
  - Further reduced use of liquid polymer
  - Weight reduction on carrier
  - Mask is automatically generated (time savings and accuracy)
  - Professional & industrial appearance