Technology Coaching BvbA
Belgium

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USB Microscope used for print process control.
Using this handheld microscope with the latest in print evaluation software

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MR STREEFLAND HAS WORKED IN THE PRINTING INDUSTRY SINCE 1992. DURING THIS TIME, HE HAS BEEN TECHNOLOGY DEVELOPMENT MANAGER FOR SCA PACKAGING AS WELL AS TECHNICAL MANAGER AT STORK SCREENS. HE STARTED TECHNOLOGY COACHING BVBA IN FEBRUARY 2005.

USB Print Microscope used for measuring in the print process.
Using this handheld microscope with the latest in print evaluation software

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The essence of ingenuity is simplicity!

A USB Print Inspection Microscope

USB Microscope used for measuring in the print process

- Demonstration of the USB print microscope;
- How important is it to know the minimum dot size you can print;
- Can you measure dot area coverage using a densitometer;
- Demonstration of 3 software tools for the USB print microscope.

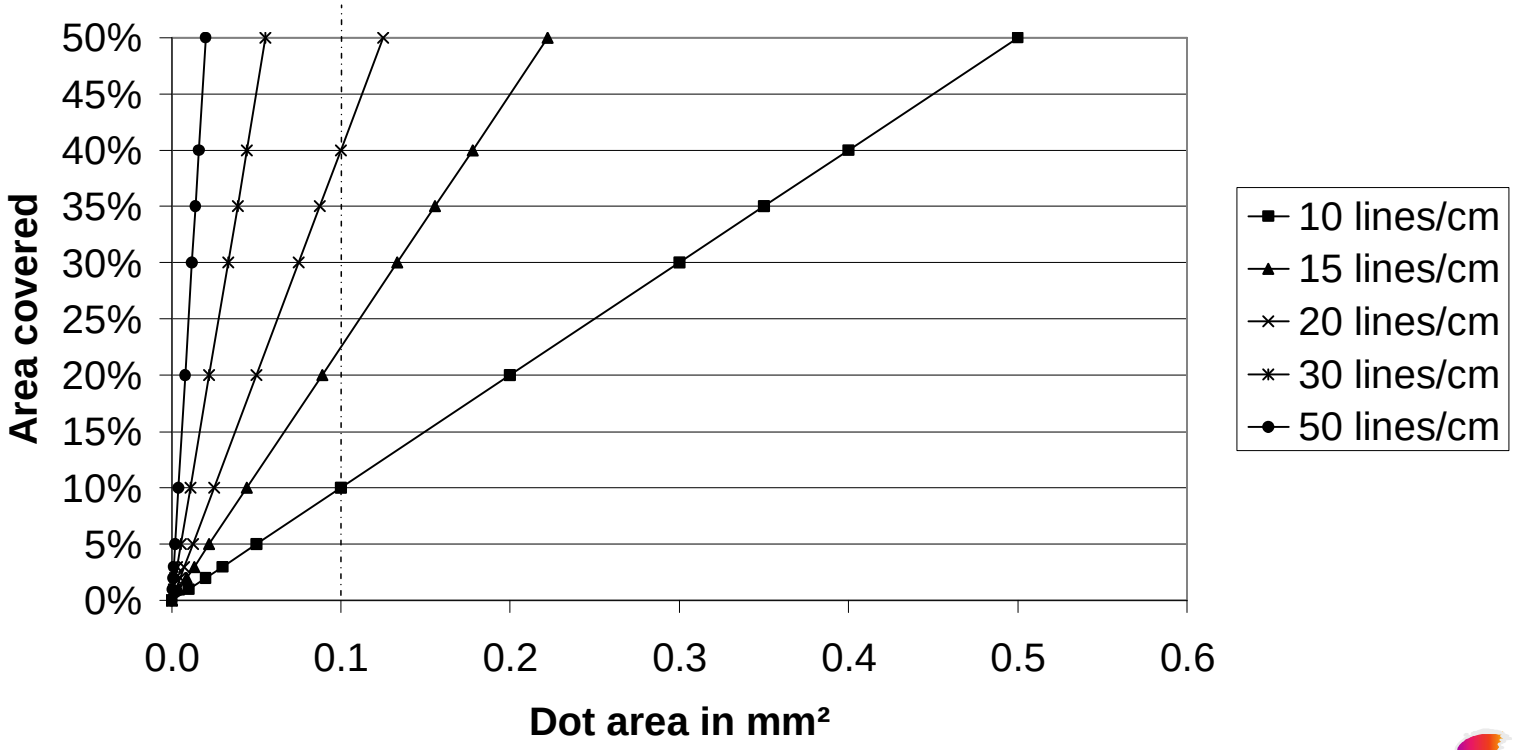
How often have you been looking at print through a magnifier and handed it over to someone else to look at the same object asking yourself what he would be looking at?

With this device you can both look at the image at the same time on the screen of your PC and record images!

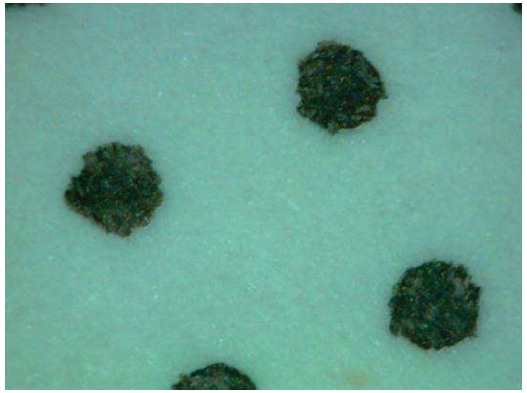
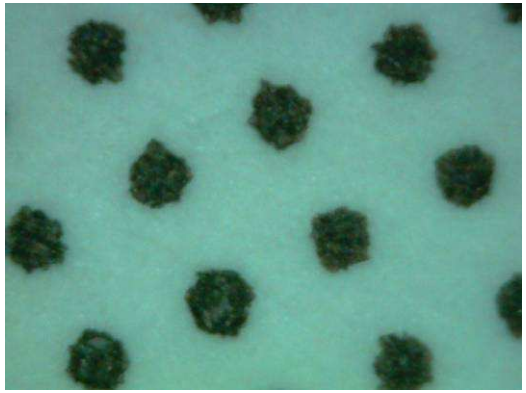
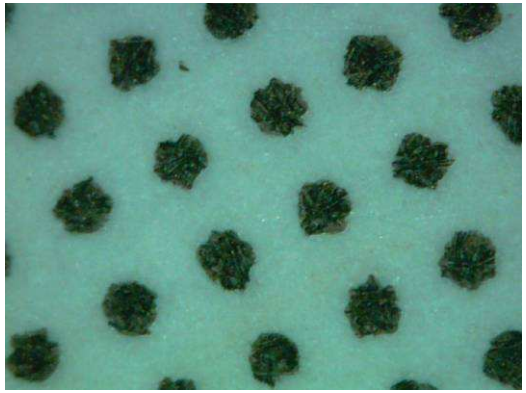
Minimum Dot Size

Is the minimum Negative or Positive dot size printed independent of the screen count used in an Image?

Calculated Dot Size



Comparing Printed Dot Size

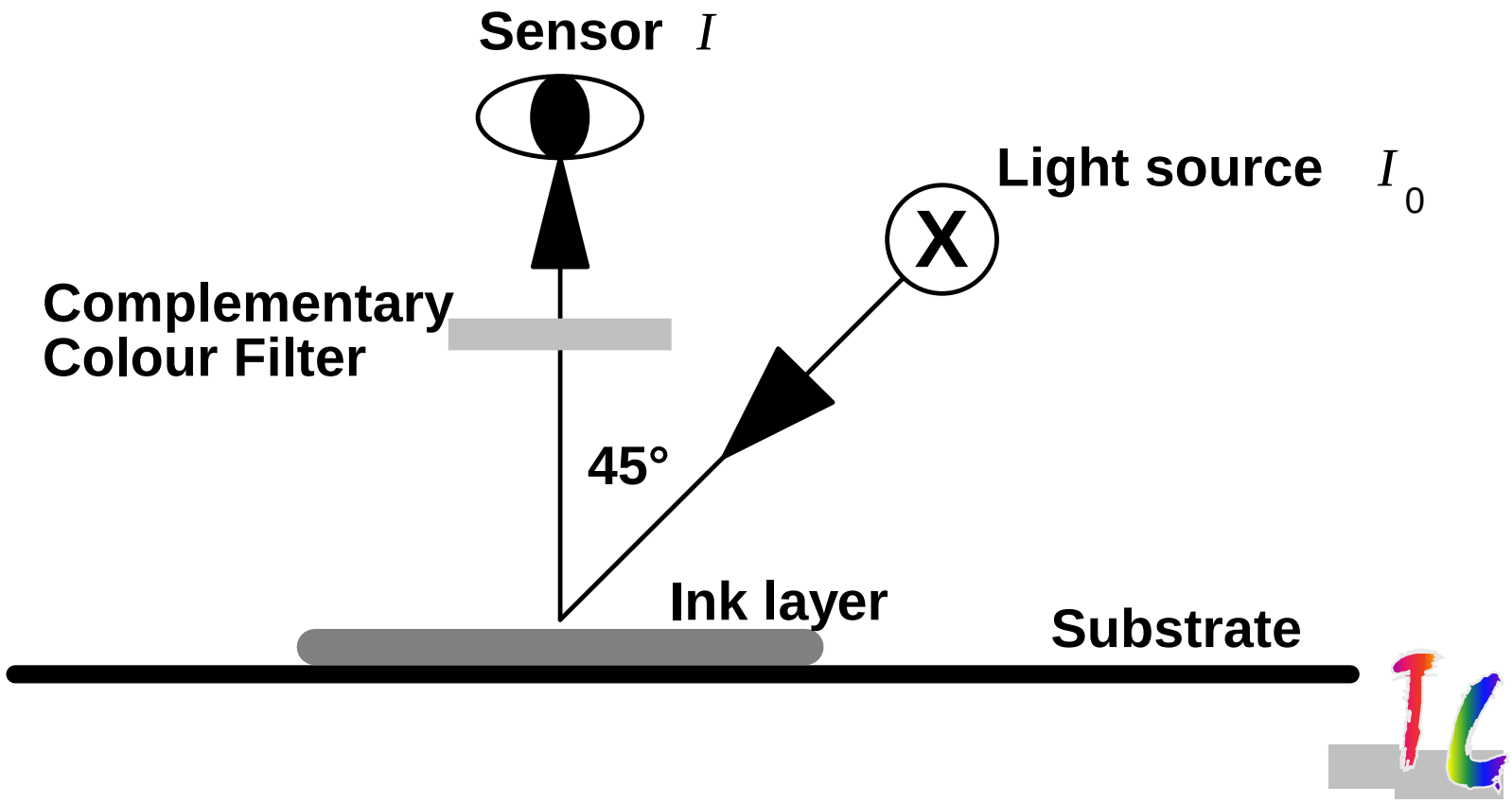
Flexo printed Dot: 200x Magnification, 2% coverage, 12 L/cm, calculated dot area 0,014mm²	Flexo printed Dot: 200x Magnification, 5% coverage, 20 L/cm, calculated dot area 0,013mm²	Flexo printed Dot: 200x Magnif., 10% coverage, 30 L/cm, calculated dot area 0,011mm²
Measured cov.: 10.68 %	Measured cov.: 16.79 %	Measured cov.: 20.86 %
Measured diam.: 0.31 mm	Measured diam.: 0.20 mm	Measured diam.: 0.18
Actual area: 0.075 mm²	Actual area: 0.032 mm²	Actual area: 0.025 mm²
		

Note that there is not that big a difference in the 3 dot sizes!

Comments to Dot Size

- Do we know what the dot size variation is in a printed halftone area?
- Is using a higher screen count in print really evidence for achieving a higher print quality?
- The smallest dot a print process can print is independent of the screen count used in the image;
- The print contrast range is limited for high screen counts depending on the dot size variation.

The Densitometer measuring principle



The equation and filtering used to calculate density

$$D = \log \frac{I_0}{I}$$

D = Colour density

I_0 = Light send (100%)

I = Light returend (between 0 - 100%)

Measured process colour:	Filtered colours:	Complementary colour of the filter used for measuring density:
Yellow	Red + Green	Blue
Magenta	Red + Blue	Green
Cyan	Green + Blue	Red
Black	Non	Transparent

The equations used to calculate dot area from density readings

Murray-Davis equation:

$$C_a = \frac{1-10^{-D_h}}{1-10^{-D_f}} * 100$$

$C_a =$ Percentage covered area

$D_f =$ Density full tone area

$D_h =$ Density halftone area

The linear dot gain equation

$$C_{a\_cor} = C_a + (100 - C_a) * \frac{a}{100}$$

C_{a_cor} = Corrected percentage covered area

C_a = Percentage covered area film

a = Covered area constant (0 - 100)

Error calculation

Is using colour density readings, for determining dot area coverage, really reliable?

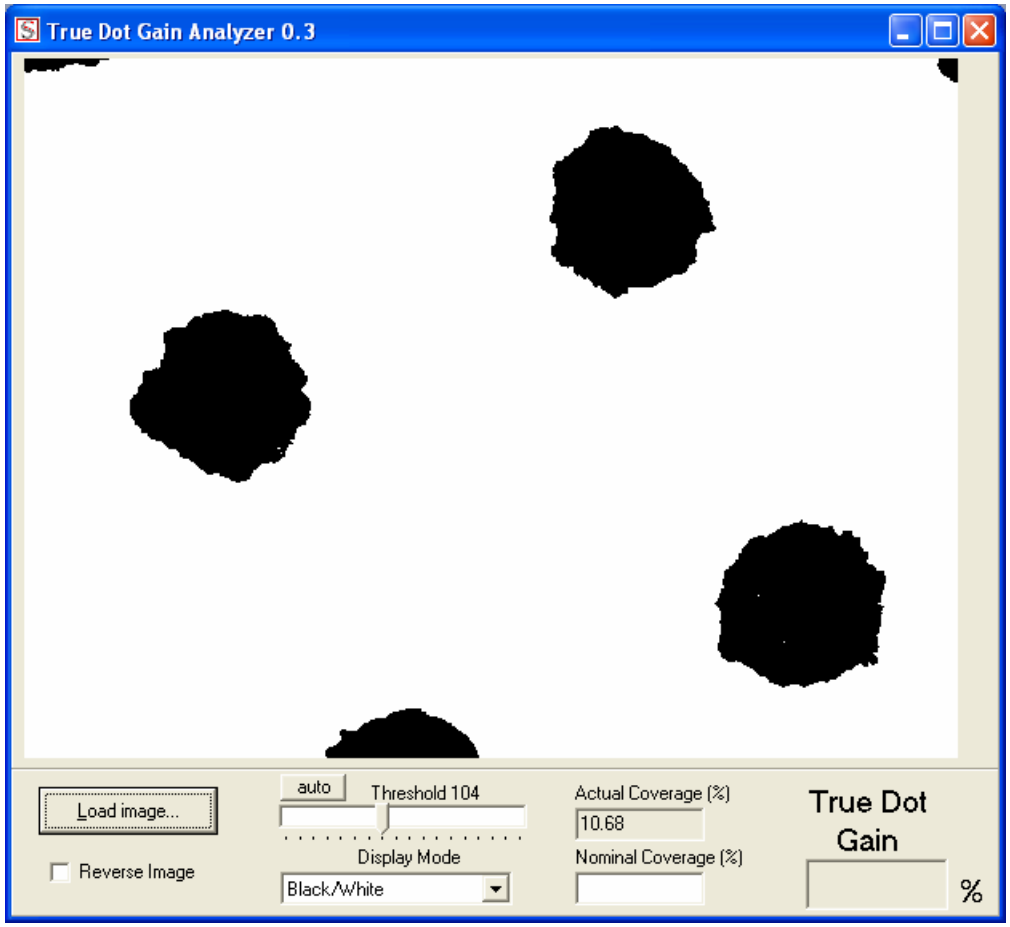
Density calculation of halftone coverage based on a given full-tone density and the error resulting from a 0.02 density reading error

Dot %	Calculated density	Dot% Error half tone
100	1.200	0.30
90	0.805	0.75
80	0.601	1.20
70	0.463	1.65
60	0.359	2.10
50	0.274	2.55
40	0.204	3.00
30	0.143	3.45
20	0.090	3.90
10	0.043	4.35
5	0.021	4.58
3	0.012	4.67
2	0.008	4.71

But what can we do more?

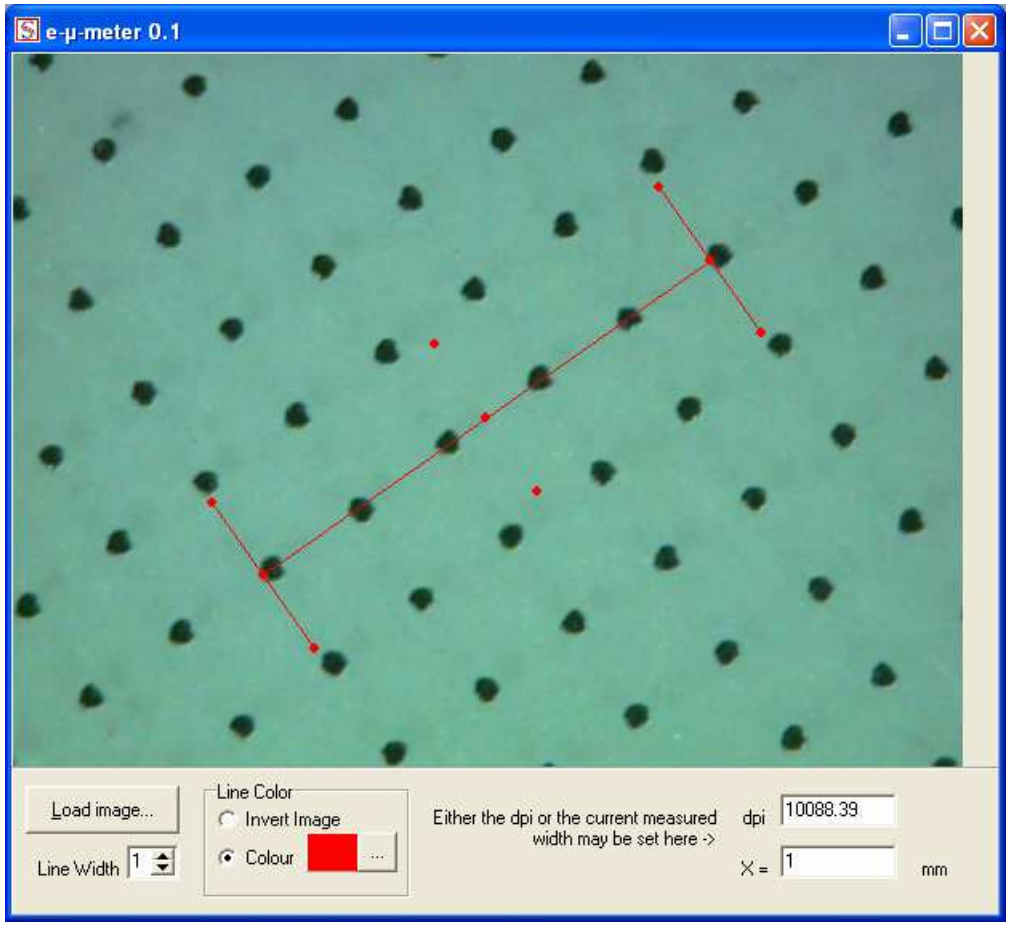
- Measuring Distance in an image;
- Measuring screen count;
- Measuring Dot Gain;

Measuring Dot Coverage



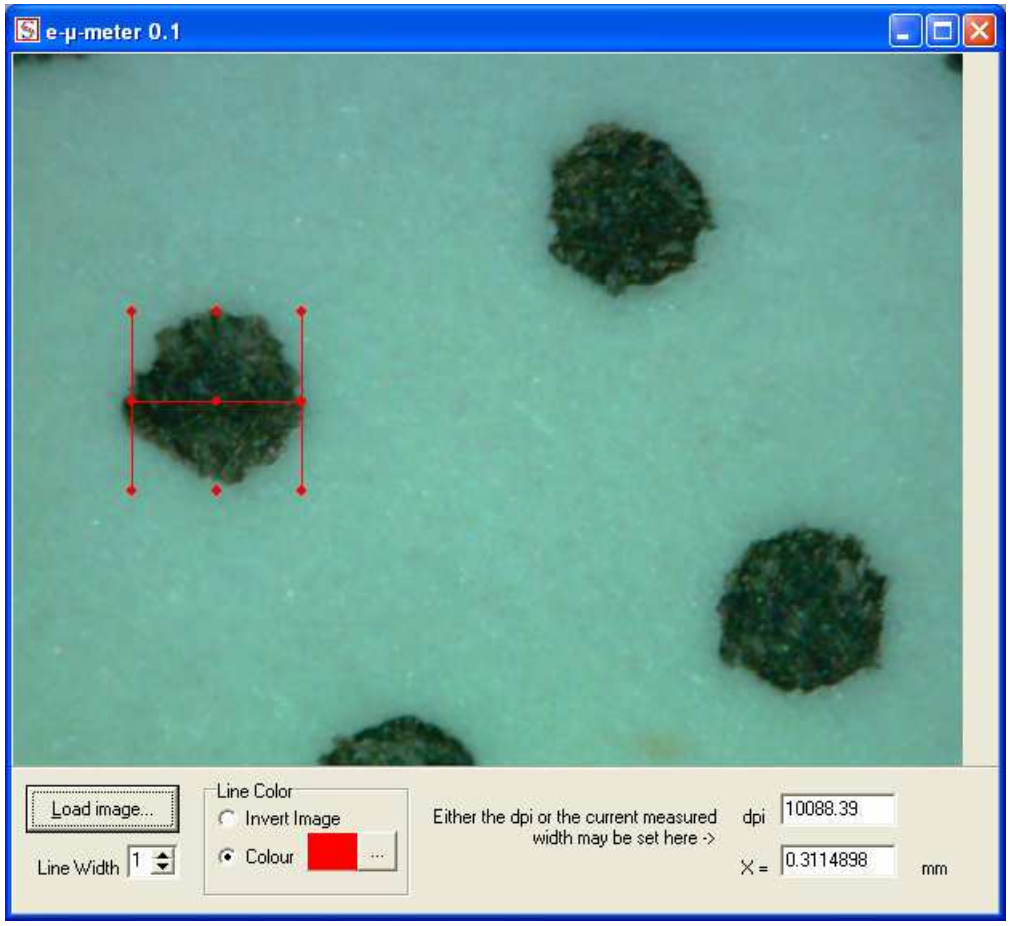
- 2 % dot at 12 L/cm flexo post printed;
- Actual Coverage: 10.68 %

Measuring Dot Size Calibration



- Calibration was done on a 50 L/cm film;
- 5 lines is 1 mm

Measuring Dot Size



- 2 % dot at 12 L/cm flexo post printed;
- Actual Dot Diameter: 0.31 mm
- Actual Dot Area: 0.075 mm²

Summery

- There is a minimum dot size you can print independent of the screen count used in the image;
- Care must be taken when using a densitometer for evaluating dot area/dot gain;
- The USB print microscope can give you a value for dot area based on image analysis;
- Using the USB print microscope it is possible to accurately measure the size of a dot;
- Print quality needs to be expressed quantitatively

Time for your Questions.

Thank you for your attention.

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