Extending Decorative opportunities

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28th October 2022

Ricoh Europe PLC

DECORTECH CONFERENCE

Decorative applications of inkjet

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Inkjet decorative applications is expanding day by day

Interiors décor
HPL floor

Interior Décor – Wallpaper

Direct product decoration

Direct product decoration

Product decoration

Key messages

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Think beyond graphic decoration

Tactile and structure
Surface properties
Functional

Don’t chase unrealistic specifications

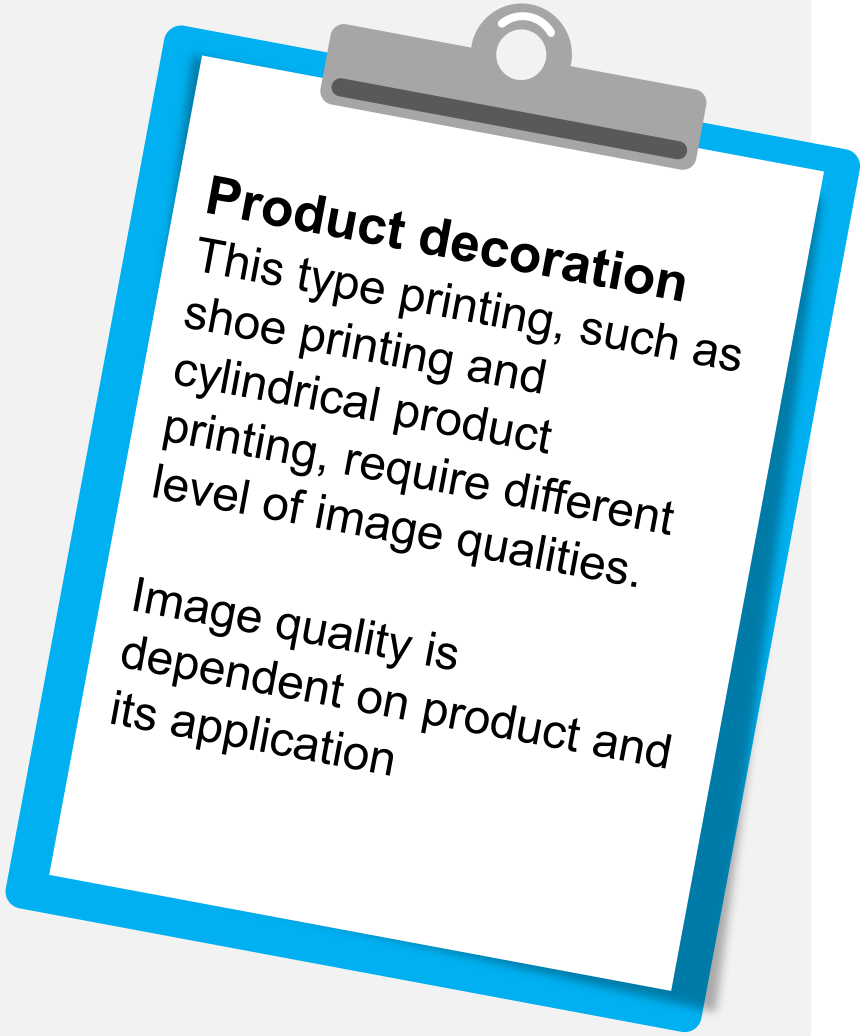
Fit for purpose
Acceptable to consumers – ultimate customers
Appropriate resolution
balanced printing to whole process throughput
Printhead to accommodate fluid not vice-versa

Produce on demand and as close to market and customer as possible

Environmental – carbon footprint
Reduced delays
Less inventory
Less wastage (scrap, obsolescence, deterioration in stock over time…= money)

Image quality requirements

Decorative printing is no long just printing a pattern which is what ceramic production printing does. It is more about graphic quality



Decorative and functional

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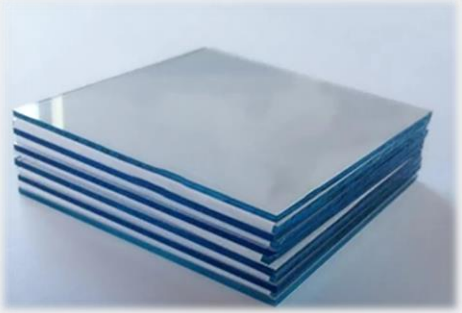
Anti-slippery tiles

Lens with multi functions

Innovation

Self clean glass

Tiles/glass with conductive trace



Energy harvesting

Image (Print) quality assessment

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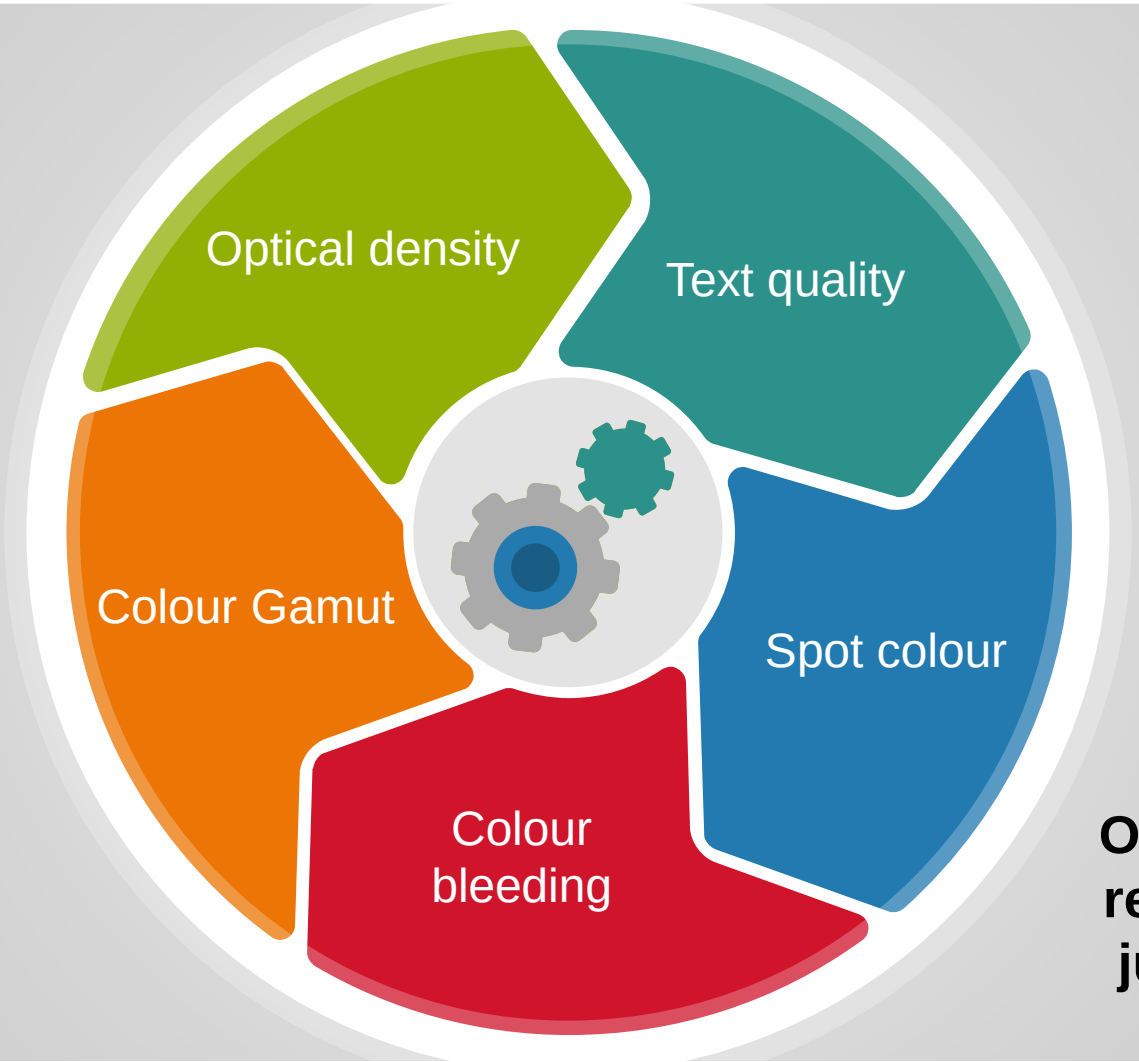
Measurable criteria



What about non-measurable criteria?

Our eyes are the final receiver and the final judgement of image quality

Line Per Inch (LPI) vs Dot Per Inch (DPI)

Digitally printed by Velox

- A beverage can is normally printed approx. 90-100LPI. Have we ever questioned about those image quality when we drink?
- For beverage can printing, colour to colour gap need to be keep away approx. 50um in the artwork.
- 50um gap is equivalent to 500dpi in inkjet.

Printhead design drop size vs resolution

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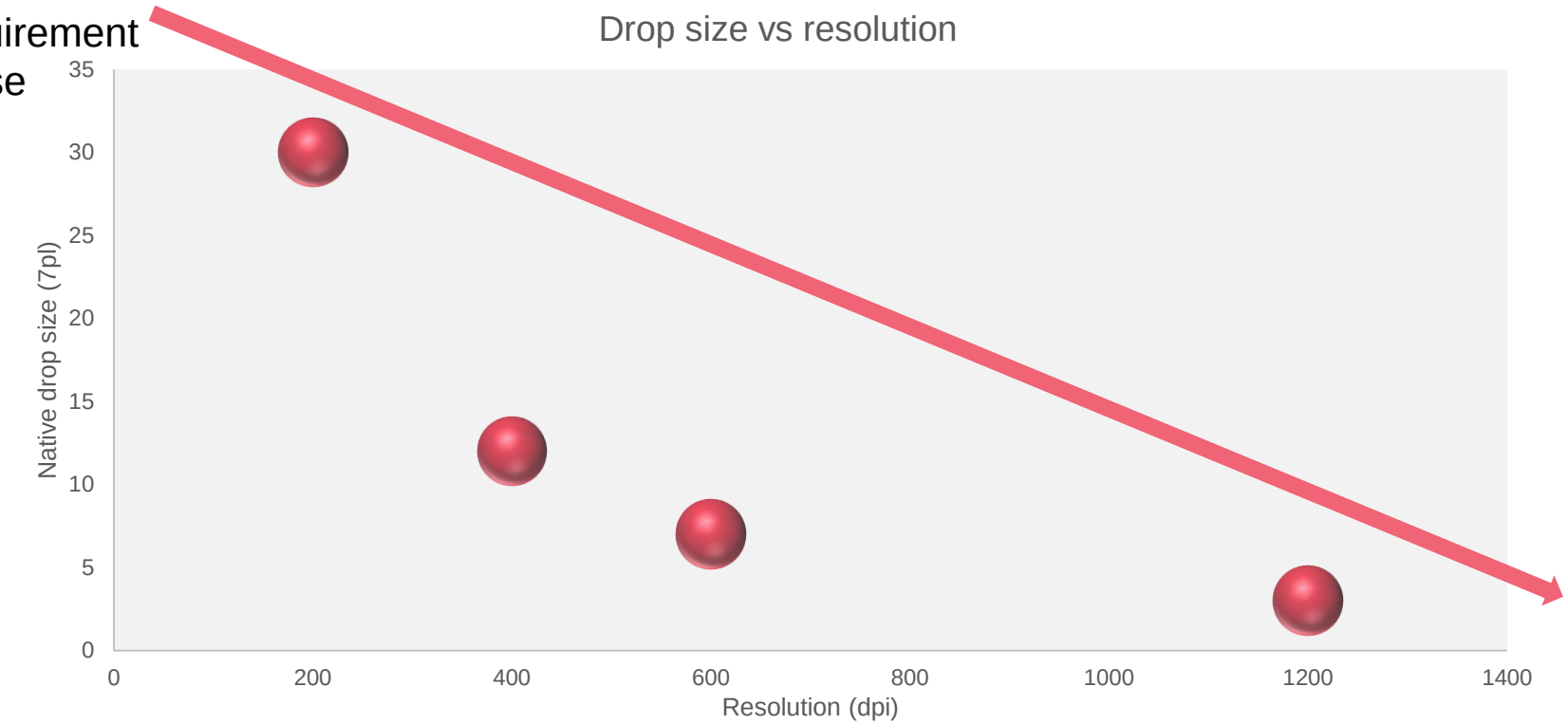
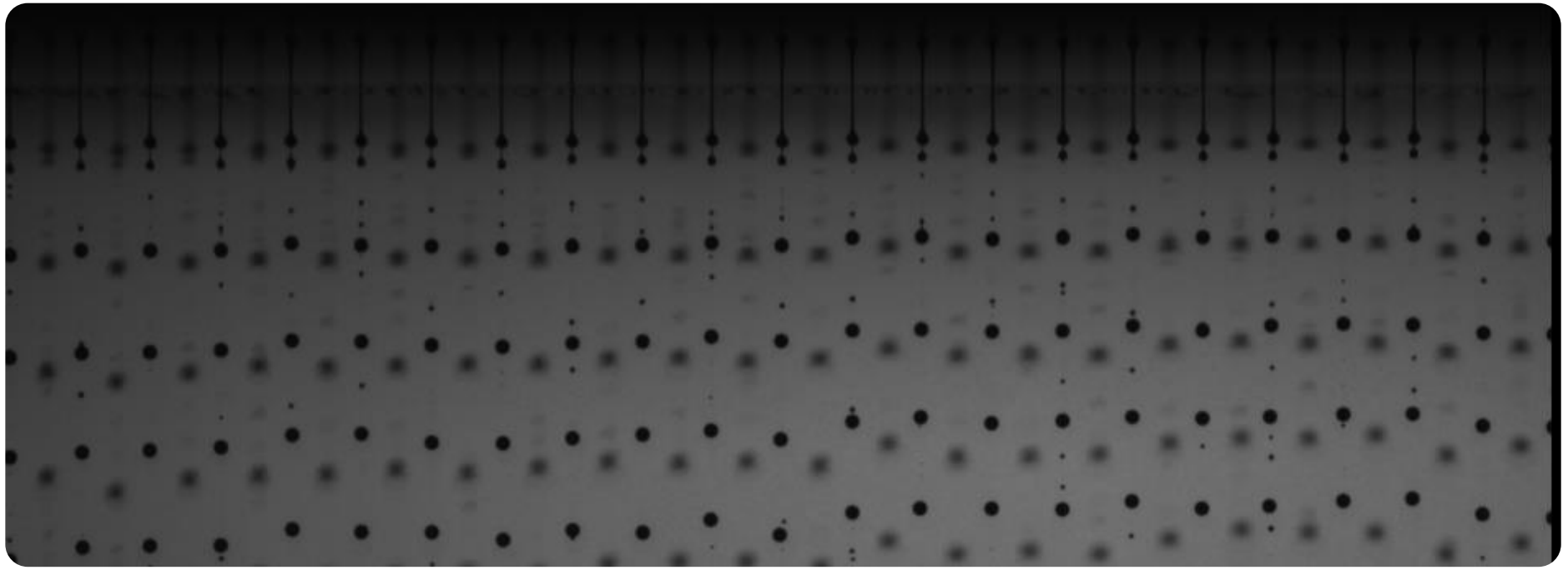
Reliability
Accurate landing
Dot consistency
Speed more possible
Light data flow requirement
Imaging compromise



Vulnerability
Turbulent effect
Inaccurate landing
Satellites
Speed compromise
Heavy data flow
Image improvement
Fluid compromise

Drop size and full ink coverage are calculated during printhead design stage

Satellite/small drop is enemy to stability



Small satellites stay in the air and accumulate on nozzle plate

Satellite is a big enemy to jetting stability.

If the native drop size too small, which will be very difficult to maintain stable jetting.

Resolution – simple calculations

For 600x600 dpi

- Dot pitch is 42um
- Solid density coverage need 59um dot
- 18-20pl ink drop is big enough to give 59um diameter dot on substrate in most cases

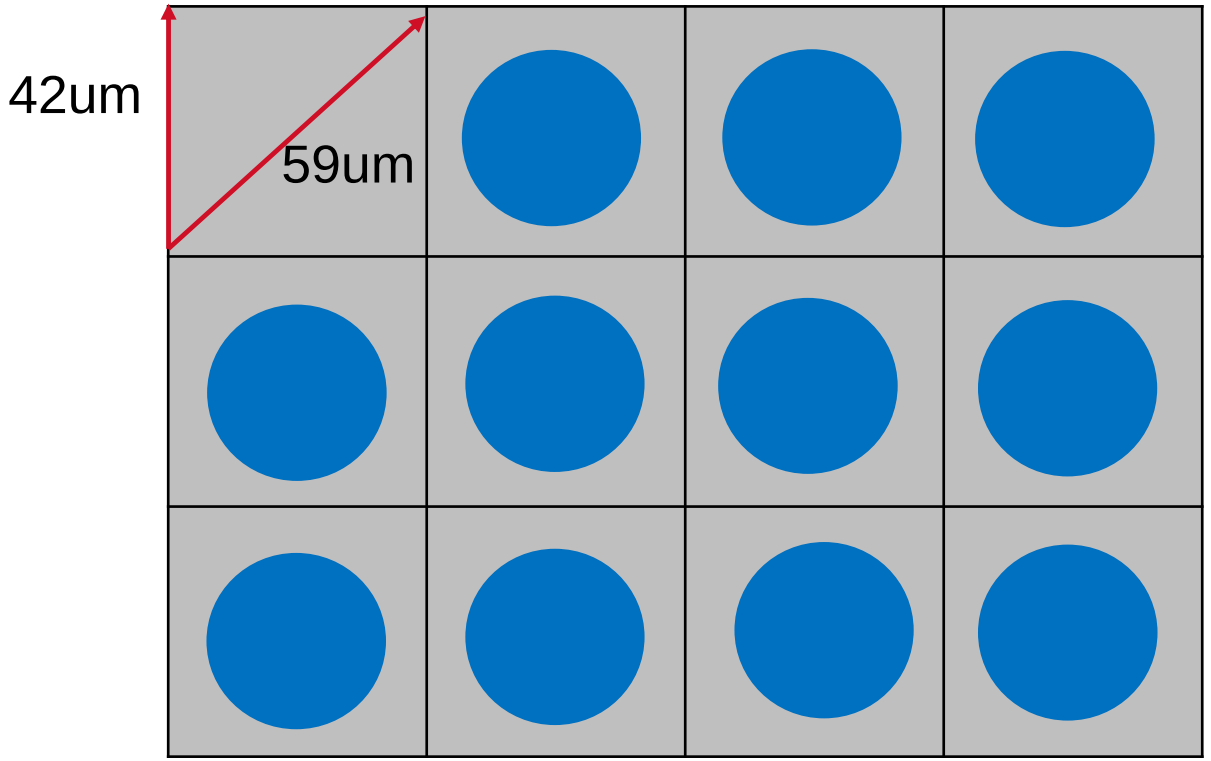


Image quality is also defined by drop size

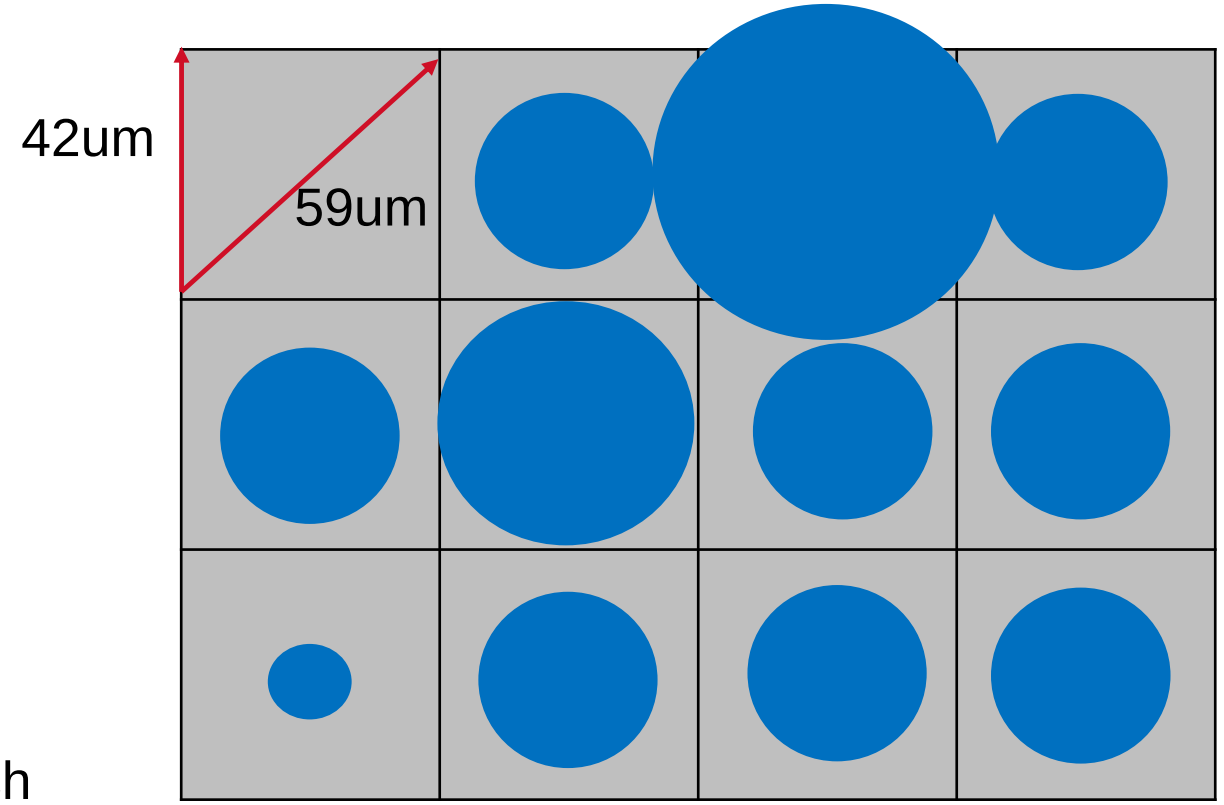
Applicable drop size

Native drop size

- <4pl: Difficult to control and giving issues, such as unstable jetting, misting.
- 5-7pl: reasonable
- >10pl: noticeable image quality difference

Resolution @7pl

- 600x600dpi printhead: x3 passes would reach saturated coverage.
- 300 dpi printhead: >x6 passes to reach saturated coverage



Printer design

Multi pass

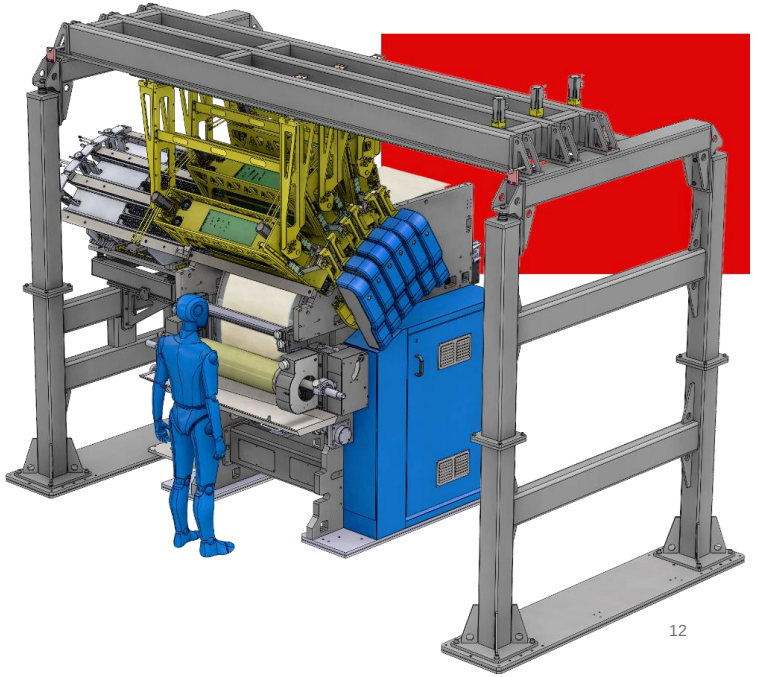
Lower resolution = more passes = lower productivity

Higher resolution = fewer passes (potentially) = higher productivity

Lower resolution = larger or multiple drops = better dot placement

Higher resolution = binary printing and, by definition, less certain dot placement

Balance between image quality (theoretical and real) and productivity



Single pass

Lower resolution = fewer nozzles = lower cost, 300dpi = kHz/300

Higher res = more nozzles = higher cost, 1200dpi = kHz/1200

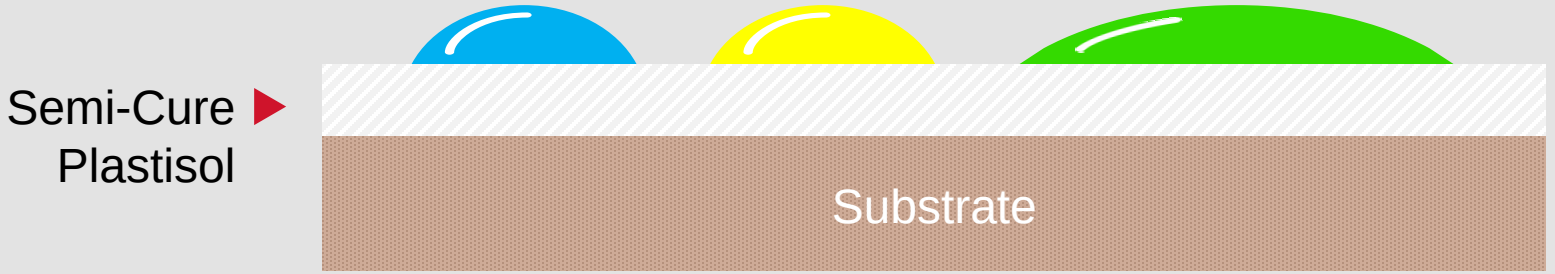
Data flow is proportionate to resolution (X & Y & greyscale)

Image quality by controlling dot spreading

Image quality can be improve by controlling dot spreading on substrate

Dot can be controlled to expected size and enhance colour appearance

Wet on Dry



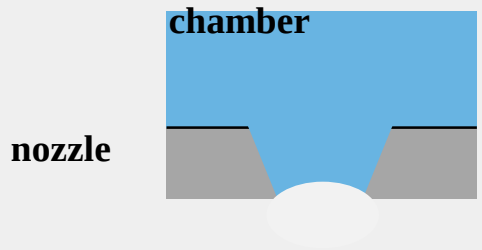
Wet on Wet

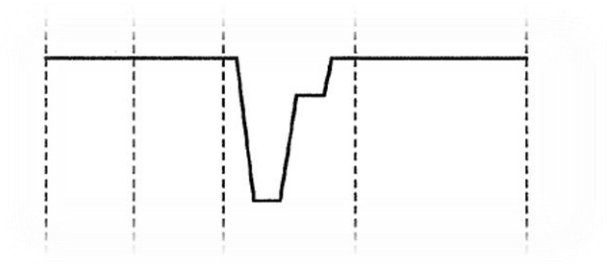
Ricoh patented technology for wallpaper, etc. applications

Flexibility for drop size - waveform

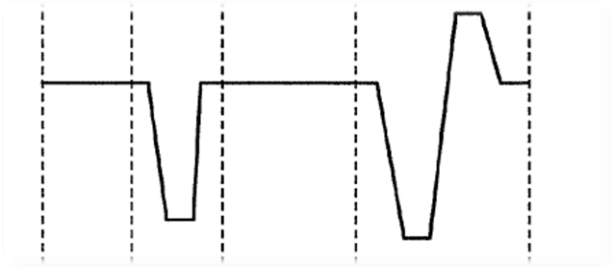
It is about timing and amplitude of control

"High Definition" waveform shapes give more control, also give variable drop size flexibility

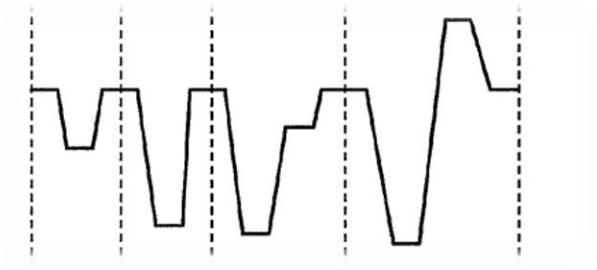




Small droplet



Medium droplet



Large droplet

Recirculation needed?

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Printer configuration

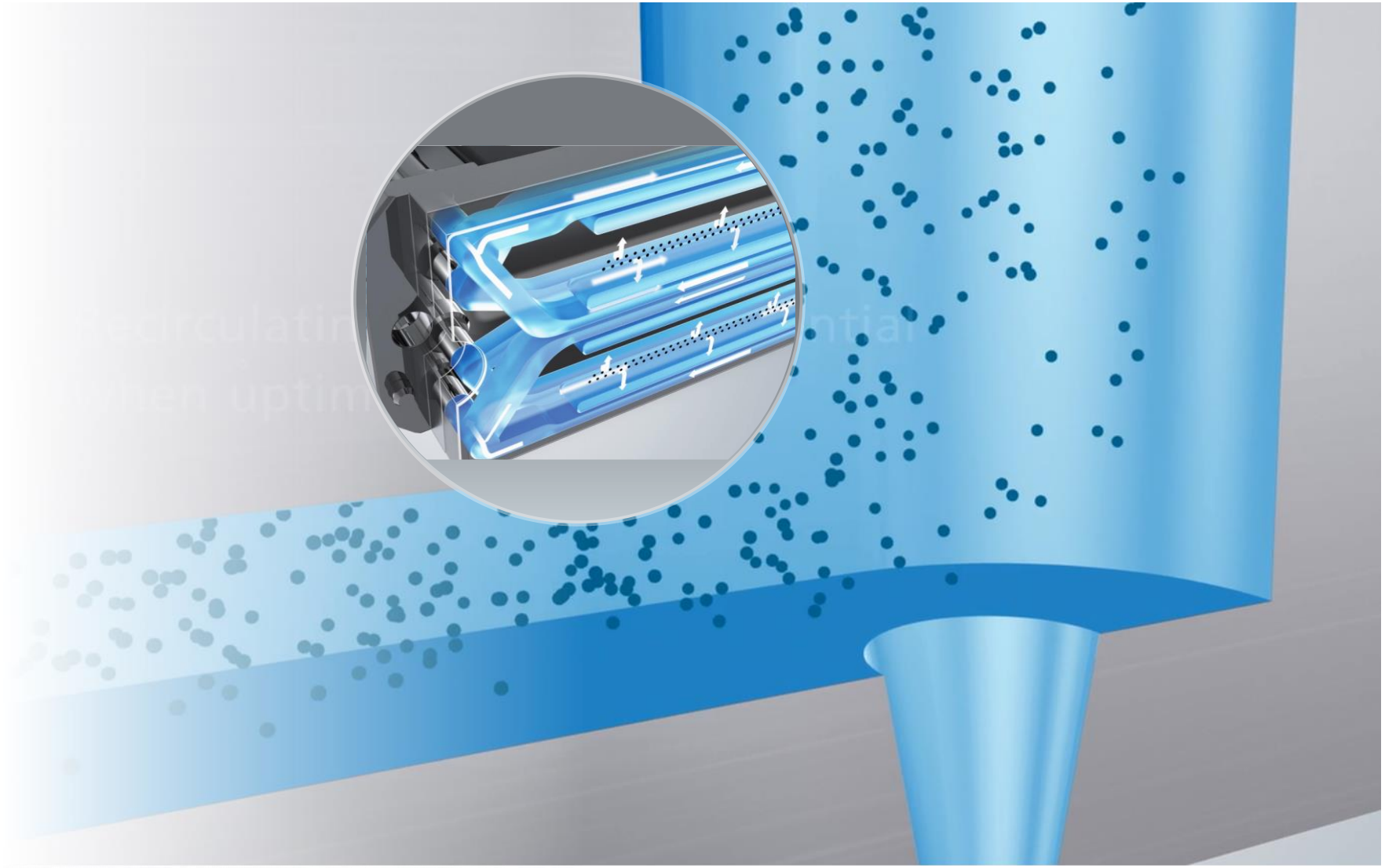
Single pass
Multiple passes

Ink type

UV
Aqueous
Heavy particle load
Others

Cost

Ink delivery system
Temperature condition



Remarks

- Inkjet is adopted in many decorative applications and expanding fast.
- Not necessary have to always chasing highest resolution and smallest drop size.
- If x2 resolution and ½ drop size, the challenges to mechanical accuracy and data processing will be multiple times.
- 1200dpi printhead is not necessary for most decorative applications. 600dpi would be enough.
- Image quality is not always high resolution and smaller drop size. There are also other techniques can significant improve image quality.

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