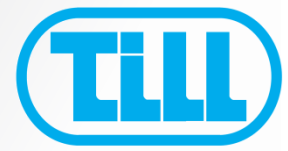# Inkjet decoration of curved surfaces at high capacities:
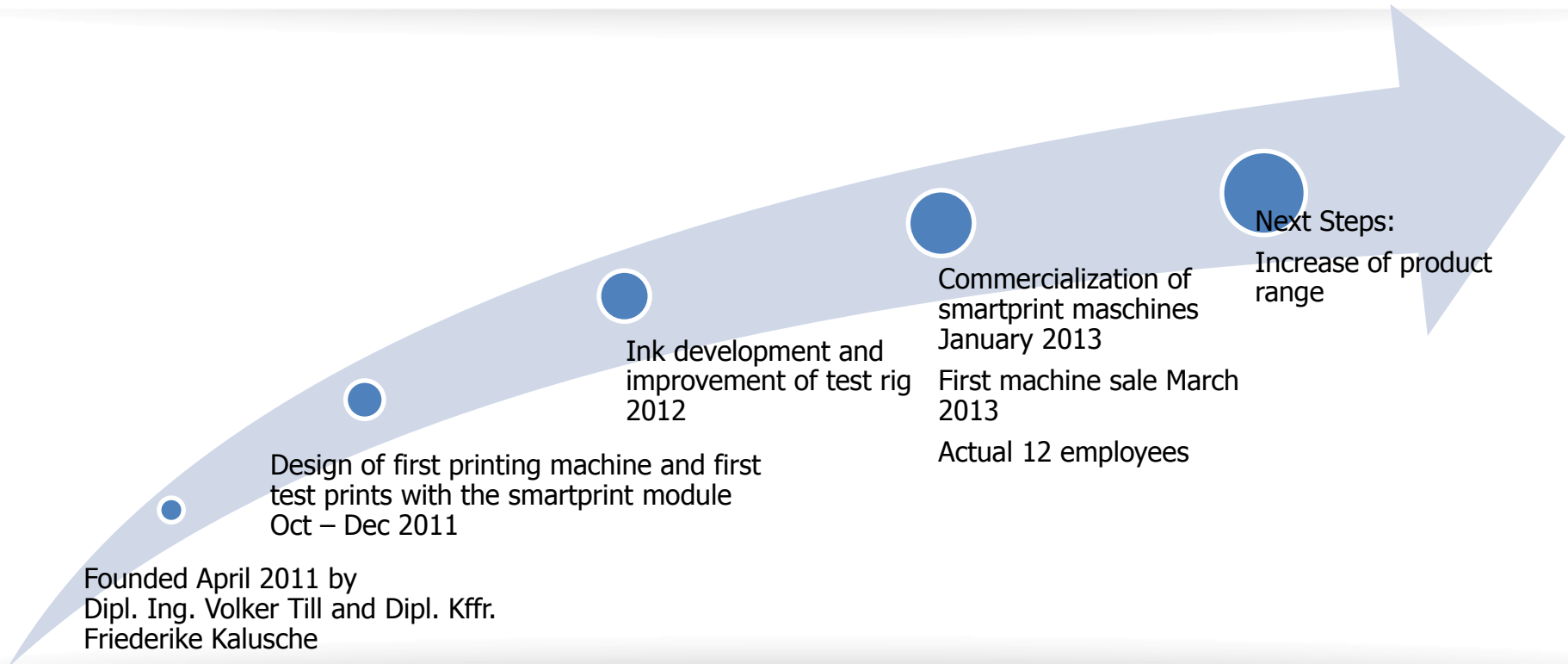
Challenges and successful implementation
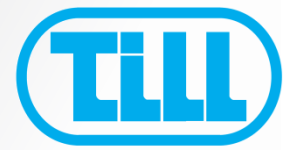
Volker Till

Till GmbH

Till GmbH - our road to success

Next Steps:

Increase of product range

Commercialization of smartprint maschines January 2013

First machine sale March 2013

Actual 12 employees

Ink development and improvement of test rig 2012

Design of first printing machine and first test prints with the smartprint module Oct – Dec 2011

Founded April 2011 by Dipl. Ing. Volker Till and Dipl. Kffr. Friederike Kalusche

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Packaging industry

Primary packaging:

Filling, bottling:
Print on bottles

Secondary packaging:

Insert into carton
Shrink wrap
Print on carton

Third packaging:

Shrink wrap
Sales presentation cartons
Print on carton or foil

Palettizing:

Pallett sales: orientation of packages
on the palett

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Digital decoration offers advantages over labeling

- Suitable for
  - Glass, plastics, metal

- All kind of industry
  - Beverage
  - General food
  - Household chemicals
  - Cosmetics
  - Pharmaceuticals
  - Cartouches

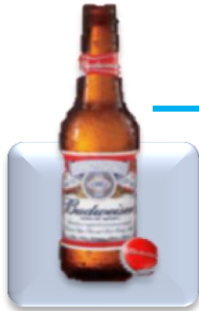- Different container shapes
  - Flaschen, Dosen, Tuben

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High quality resolution

Our world becomes digital

DIGITAL

Actual labeling currently is laborious and expensive
Digital print is replacement of all current decoration methods

Pre-cut **paper labels** are cold glued onto the container

Self-adhesive labels are transferred from carrier foil

Screen printing requires specific screens and is limited in capacity

Rollfed labels are attached using a hot melt line

Sleeves are pulled over the container and adapt to its shape

A wide range of new marketing opportunities

TIME EFFICIENCY
- Instant printing: Lead time can be reduced from 3 months to almost zero

FLEXIBILITY
- New bottle designs possible, no need for flat surfaces, printing in grooves and embossings possible

SMALL BATCHES
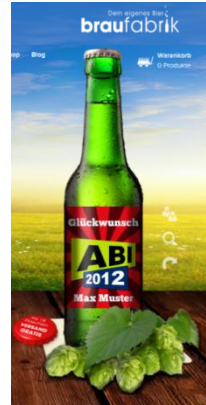- New products and new variations at low cost

DIRECT CUSTOMER RELATION
- Boost your social community, allow customers' own design

FREEDOM OF DESIGN
- Every bottle can be different, new sale opportunities over internet; make more space available for your message

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Customization currently is a niche market

Brand owners already use „limited editions"…

… and start first real customization
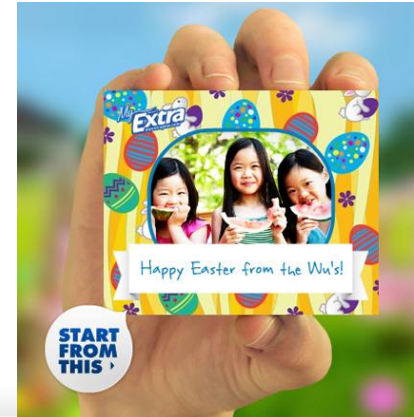
Every bottle can be customized

Variable data printing

Text and graphics

Legible text at 2 point

Database information
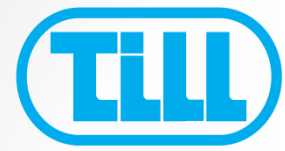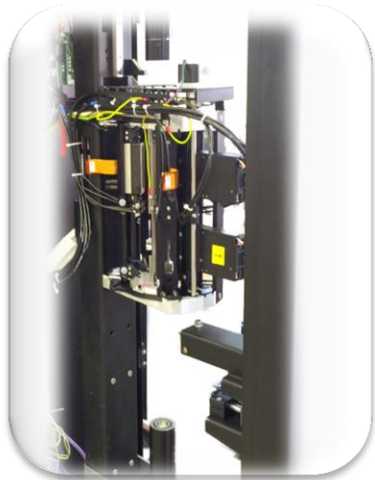
Direct Digital Decoration – an alternative to labels

Till offers the perfect inks for 3D printing

GLASS

- Very good adhesion
- Brilliant colors
- Good scratch resistance
- Waterproof

PET und PE

- Excellent adhesion
- Brilliant colors
- Good PET recycling
- Excellent scratch resistance
- Food grade with no migration
- Waterproof

METALL

- Very good adhesion
- Brilliant colors
- Good scratch resistance
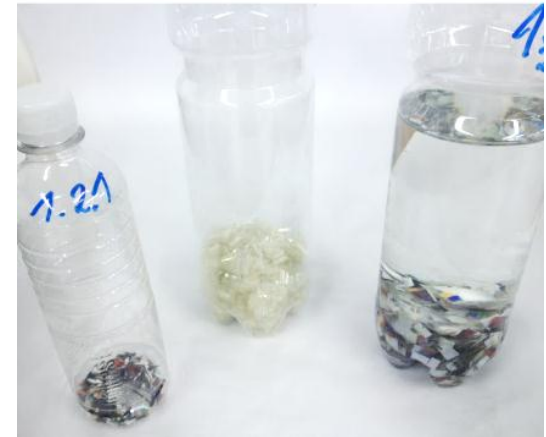- Waterproof

Adhesion and recycling

Adhesion test with
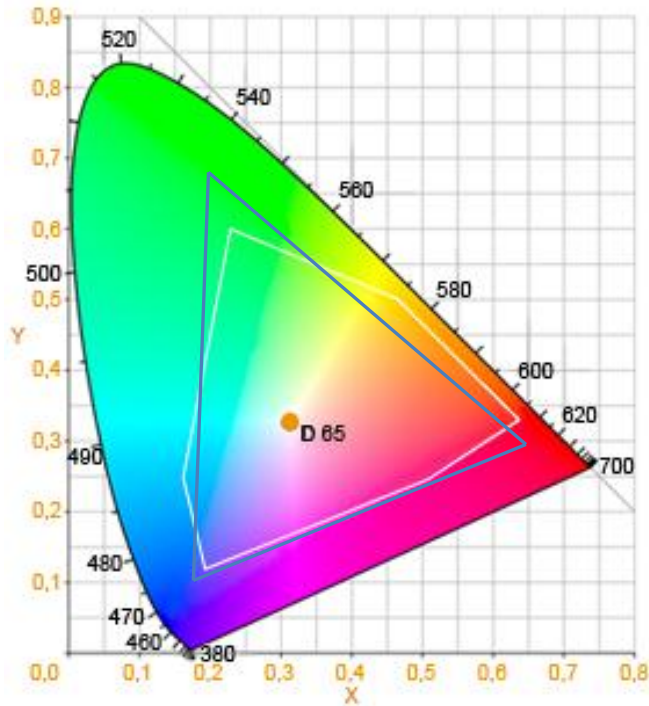cross hatch test
EN ISO 2409

Crumbling test =
Adhesion even on sharp edges

Recycability

High quality inks in CMYK and spot colors

CMYK is a subtractive color system.

Till Smartprint modules can host up to 8 colors
This allows to extend color gamut by using light magenta, light cyan and light black

Corporate colors outside CMYK color gamut can be added as spot colors.

White line: CMYK
Blue line: Monitor / TV

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High requirements for inks

- UV inks to suit high speed applications

- Suitability of drop-on-demand inkjet

- Multitude of printable materials (plastics (PET, PE, PP) but also glass and metals)

- Stability at low and high temperatures

- Stability after submerging in water for 72 hours

- Ink has be be low migration according the FDA and European regulations
  (Test according EN 1186-1 und EN 1186-3)

- Recyclability

Washed Flakes of classic bottle pretreatment method
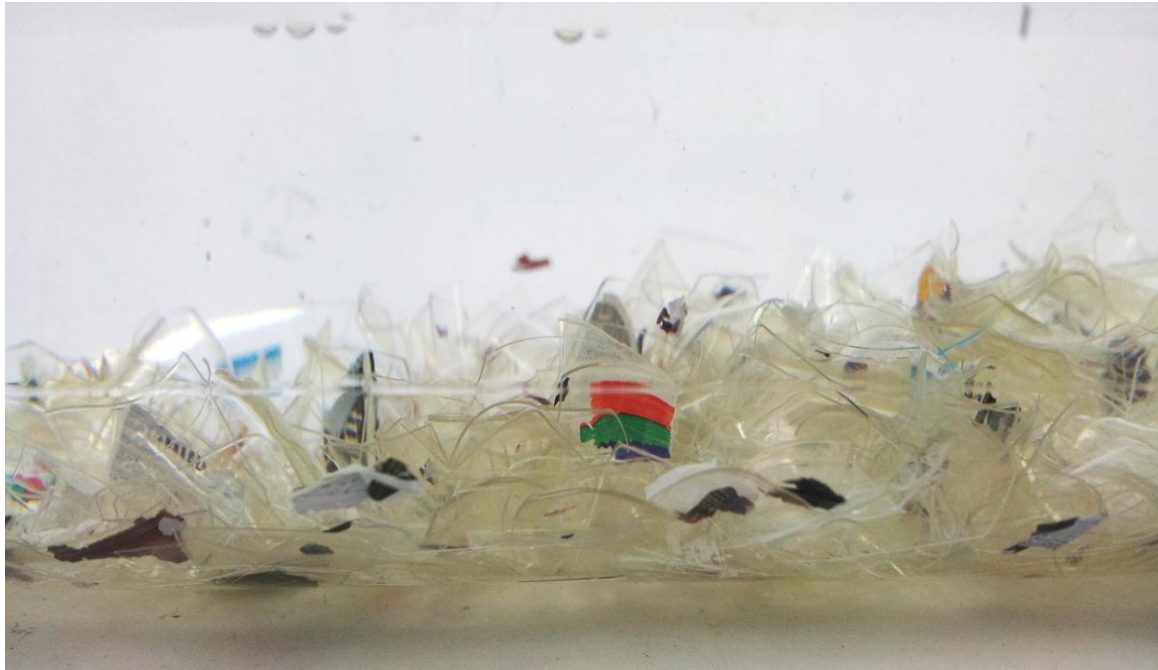
Test 5.2.1

Washed Flakes of Till bottle pretreatment method

Test 2.1.1

Comments

	Pretreatment method classical	Pretreatment method Till
Ink removal	100 %	100 %
Ink particle size	Small and Fractions	Same size as Flakes
Flake color	Colored depending on ink type	Clear, no colorisation visible
Ink / flake separation	By air flushing	By air flushing

Value and advantages for your production

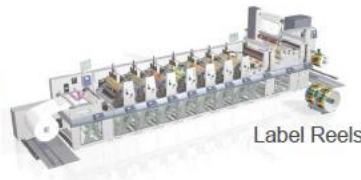| INK/LABEL COST | • Ink cost is a fraction of label cost, especially for small order quantities |
LINE CHANGEOVER	• Automatic line changeover reduces downtime of production lines
VARIETY OF DECORS	• Real "no label-look" and label-like decoration on same machine
OPERATORS	• No dedicated operator necessary
LOGISTICS	• No need for label inventory and climatised storage

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Digital decoration significantly reduces processing steps

Laminated Film → Printing Process (Label Reels) → Transportation → Reels Storage → Labeling
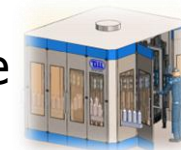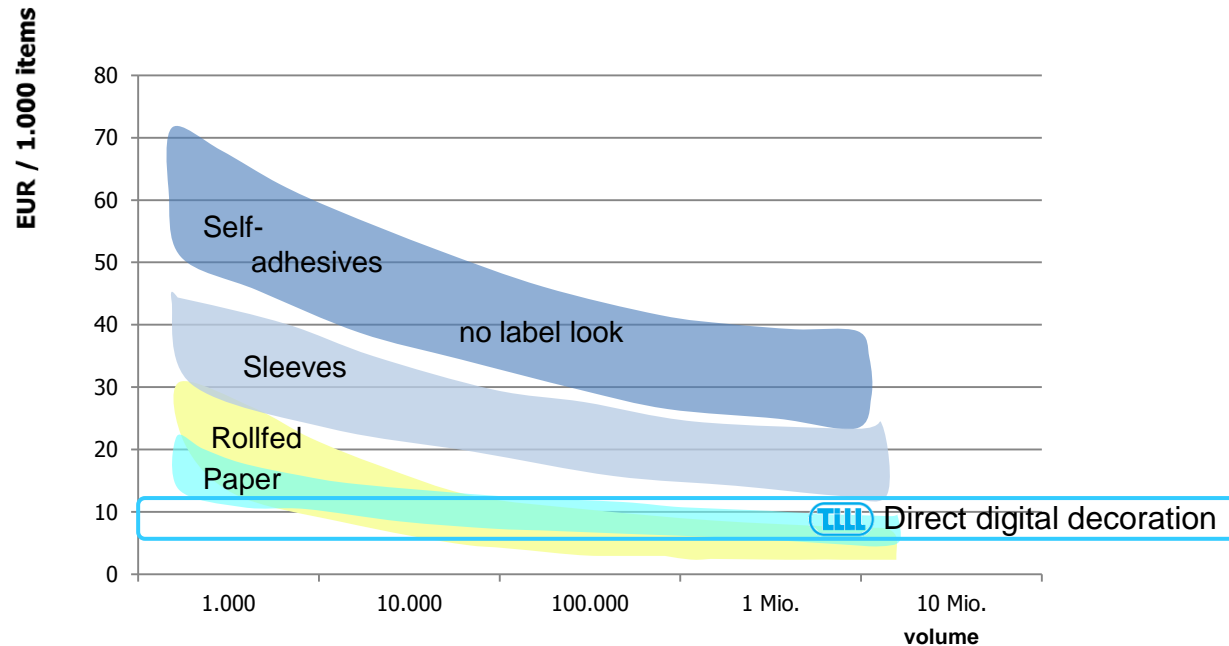
Digital decoration

Digital Decoration: for the 1st time all process steps in-house and not influenced by external suppliers

Digital decoration is cost efficient even in small volumes

Sustainability as corporate mission

NO SUBSTRATE	• Direct printing on containers eliminates the use of substrates for labels
NO GLUE	• Direct printing on containers eliminates the use of glue for labels
REDUCED WASTE	• No substrate – no waste
CO_2 SAVINGS	• The CO_2 equivalent of label substrate amount at 600 bpm up to 750t of CO_2/a
NO SPECIAL WASTE	• Labels are special waste and treatment of this is ecologically difficult

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New decoration oportunities on shaped bottle surfaces

Real no-label-look on embossings

Print on curved surfaces

Print distance up to 15 mm

Print in grooves

Textured surfaces

Current production is **product oriented**

Filler → labeler → Packing + full storage → Distributor → Shop → Customer
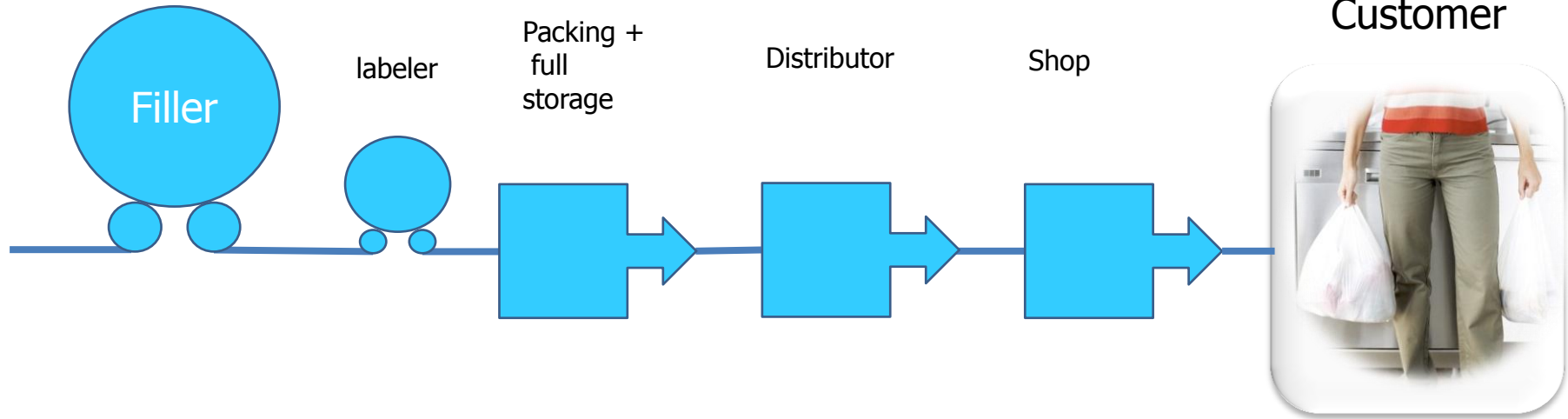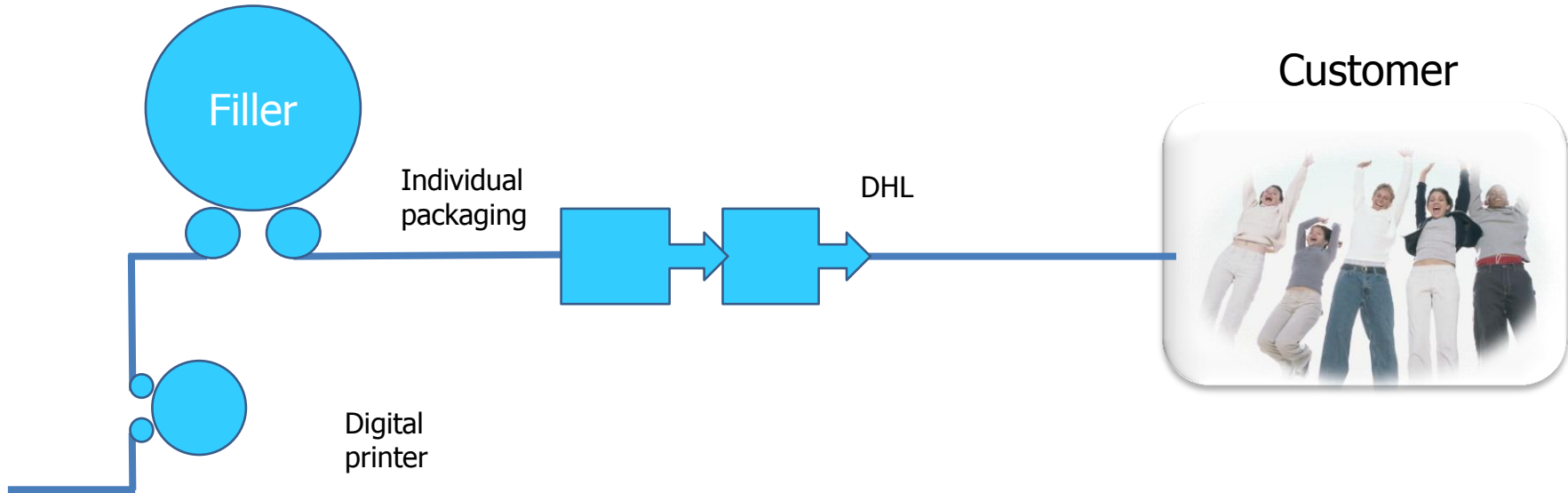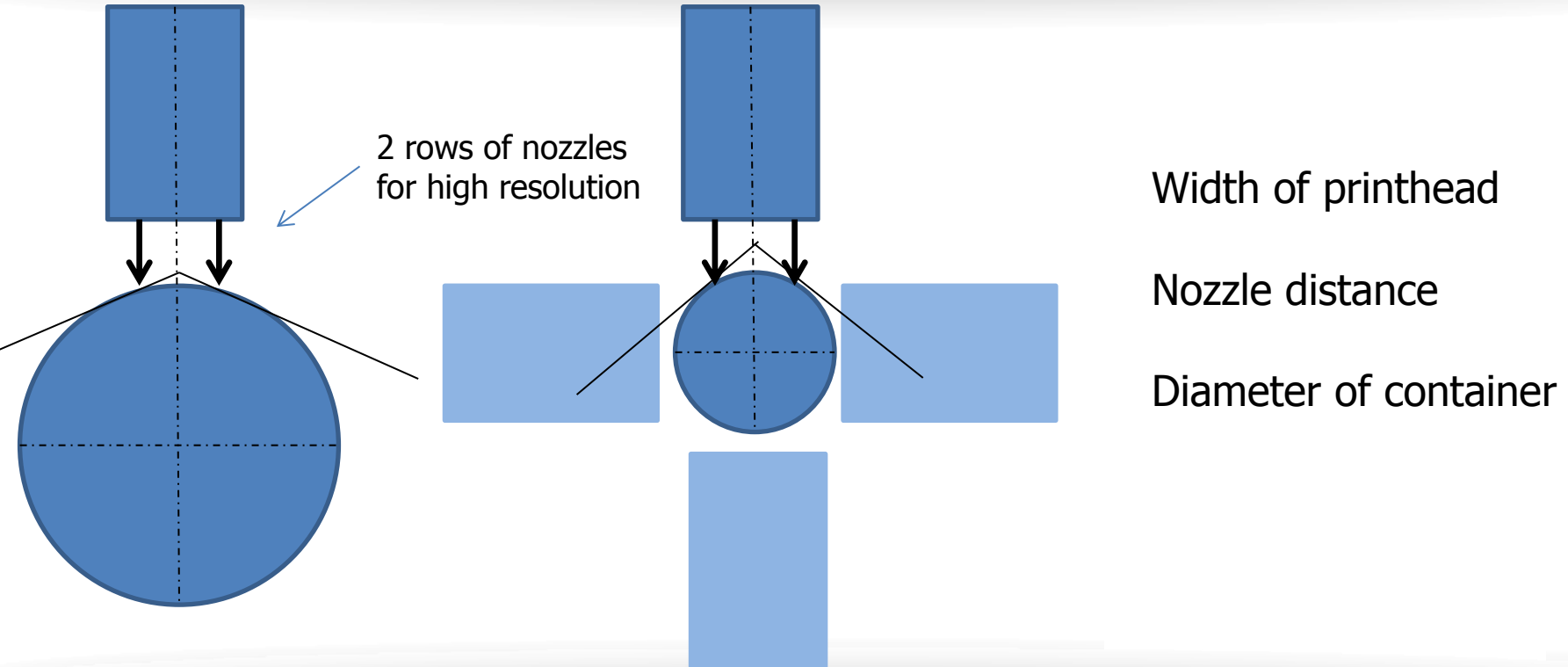
"If you focus on what customers want

and build a relationship,

they will allow you to make money".

<div align="right">Jeff Bezos (Amazon)</div>
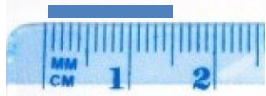
Future production will be **customer oriented**

Minimum container size is limited by print head buildup

2 rows of nozzles
for high resolution

Width of printhead

Nozzle distance

Diameter of container

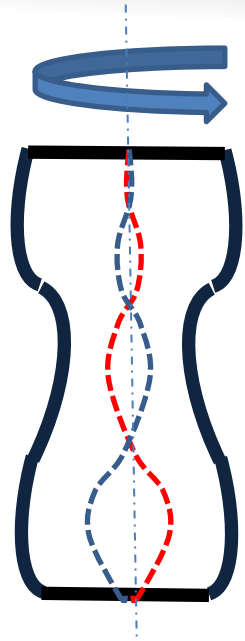# Printing distance influences image

Uncorrected 15mm distance

Uncorrected 4mm distance

- Curvature of surface results in double printing

- Precision of printing dot reduces with distance
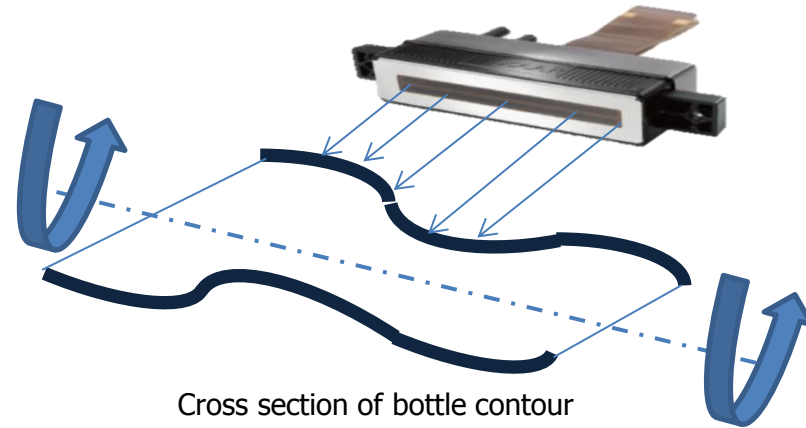
- Till software corrects these effects

Droplet flying time influence

- Droplet flying time depends on distance to surface

Small diameter =
Higher resolution =
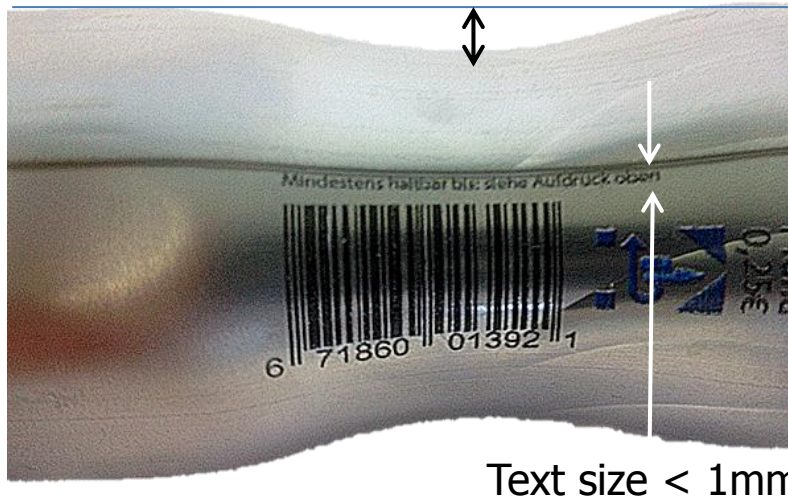Higher drop density

Cross section of bottle contour

Resulting print lines

Software correction allows up to 15mm distance

Curvature about 7 mm

Text size < 1mm

- Readability of rectified text / images on curved surfaces up to 15 mm

# Stitching necessary when design larger than print head

- Random Overlap in two steps

- Print 1, move container, print 2, pinning

- Greater height reduces machine output

Image 170 mm

Print head 70 mm

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Containers have unplanned tolerances

- Glass:
    - tolerance of manufacturing: + / - 1,5 mm
    - Mould growth over time: + 2 mm

    - Total tolerance for
      distance to printhead: ………………………………………………..0 / + 5mm

- PET:
    - Tolerance from cooling down
      and shrinking after blowing: + / - 1,5 mm

    - Total tolerance for
      distance to printhead: ……………………………………………0 / + 3 mm

Example from GIS

Modular Till Smartprint machines
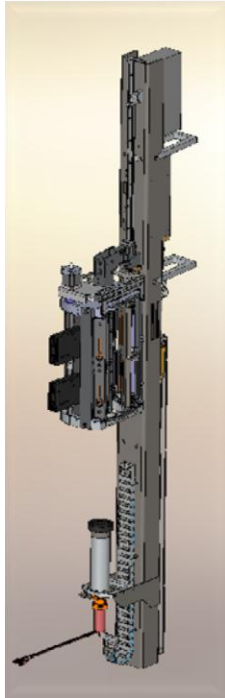
All systems are based on a slim print station being a complete printing machine on its own

Print resolution: 360 x 360 dpi with 8 grayscales

Up to 8 colors:
CMYK and white with optional 3 spot colors or varnishes
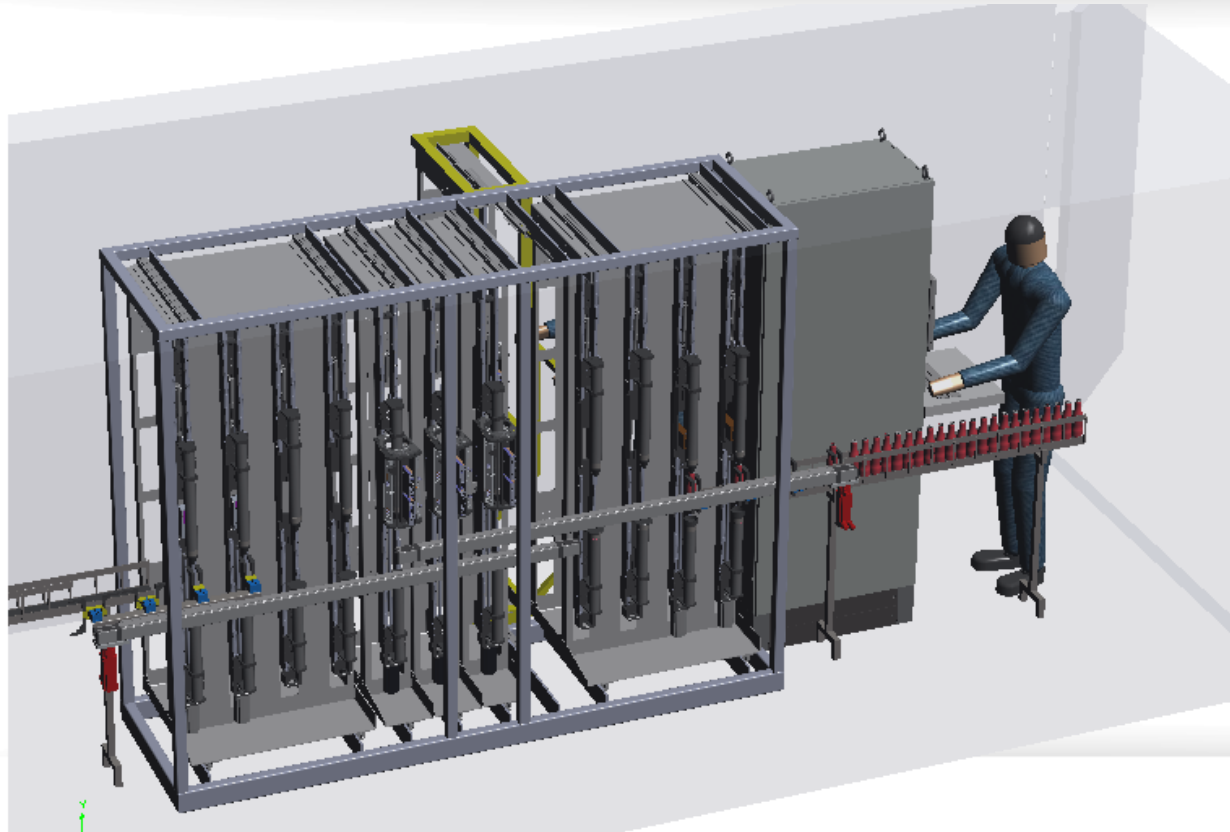
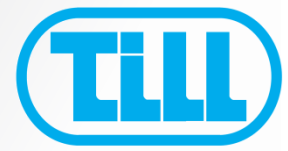Prints diameters between 50 and 100 mm
And heights from 50 to 360 mm

Each Smartprintmodule has a specific capacity

Higher output, by using a higher number of Smartprint modules

Modular Till smartprint machines – batch operation

Modular Till smartprint machines 200 – 6,000/h

CONTAINER

Substrate	Glass, metal, plastics
Diameter	50 - 100 mm
Height	Container height maximum 320 mm Printable height maximum 190 mm

PRINT

Print module	1 - 8 smartprint modules with up to 8 colors
Print heads	UV piezoelectric dod inkjet printheads
Ink type	UV curable ink
Ink supply	Optimized ink supply system
Colors	C M Y K White + 3 options
Resolution	360 dpi with 8 grayscales

SOFTWARE

|	
PLC	Till smartcontrol
RIP	Licensed imaging and correction software

PROCESS

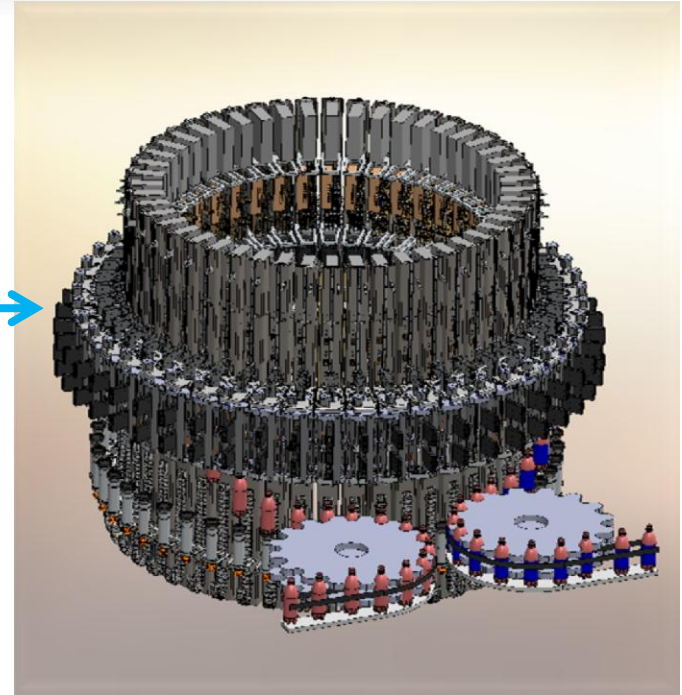|	
Handling	Batch/conveyor
Pretreatment	Included
UV curing	LED curing
Capacity	500 - 4.800 containers/h in increments of 500 containers/h

PHYSICAL

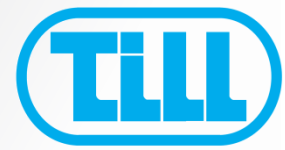|	
Connected load	8 kW basic housing 2.8 kW per smartprint module installed
Consumption	6 kWh basic housing 0.2 kWh per smartprint module installed
Air	10 Nl / min at 6 bar per smartprint module

Continuos high speed rotary printer
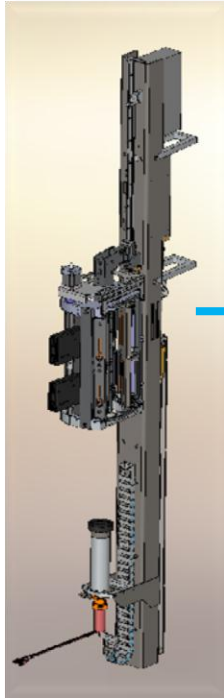
Print stations of only 140 mm width can be combined on a carousel for high speed operation

Example: up to 36,000 bph

48 print stations

Diameter: 2.3 m

Rotary Till smartprint machines 12,000 – 36,000/h

CONTAINER

Substrate	Glass, metal, plastics
Diameter	50 - 100 mm
Height	Container height maximum 320 mm Printable height maximum 190 mm

PRINT

Print module	up to 48 smartprint modules with up to 8 colors
Print heads	UV piezoelectric dod inkjet printheads
Ink type	UV curable ink
Ink supply	Optimized ink supply system
Colors	C M Y K White + 3 options
Resolution	360 dpi with 8 grayscales

SOFTWARE

PLC	Till smartcontrol
RIP	Licensed imaging and correction software

PHYSICAL

Connected load	18 kW basic carousel 1.6 kW per smartprint module installed
Consumption	12 kWh basic carousel 0.25 kWh per smartprint module installed
Air	10 Nl / min at 6 bar per smartprint module

PROCESS

Handling	Continuous motions carousel
Pretreatment	Separate module
UV curing	LED curing
Capacity	8.000 - 36.000 containers/h

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100% print inspection by camera system

Image and artwork check by 6 cameras taking an 360 degree picture to compare with printing task

All codes and text areread and validated .

Thank you!

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