

# PAPER TECHNOLOGY INTERNATIONAL

THE JOURNAL OF THE BIOFOREST PRODUCTS SECTOR



## PITA PAPER *matters!* 2018 Conference & Exhibition at Lancaster University

**Benefits of moisture based quality controls  
applied to corrugator machine  
Mikko Viitamäki (Valmet Automation)**

# PAPERmatters 2018!

The  
Presentations

Mikko Viitamäki  
Valmet



The author may be contacted via the **PITA Office**  
**Telephone:** 0300 3020 150 or **E-mail:** [info@pita.co.uk](mailto:info@pita.co.uk)



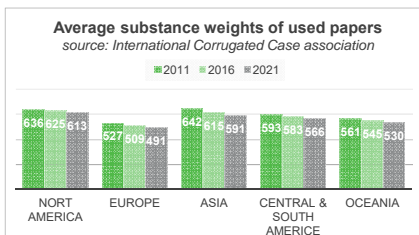
Benefits of moisture based quality controls applied to corrugator machine

Mikko Viitamäki  
Valmet  
Automation business line

Corrugated industry trends

Changing corrugated specification

1. Substance weights are declining
2. More complicated container constructions
3. More decorative printing needed
4. Increasing demand for shelf ready packages



For corrugated box maker change results in

- ✓ More complicated container constructions with better appearance are produced by using lighter raw material
- ✓ Delivery times are shorten



➔ Needs for sophisticated automation is growing fast

## Moisture management has essential role to corrugated board quality & plant productivity

Uneven MD/CD moisture profile due to

- ✓ Papermaking process
- ✓ Transportation/Storage

Re-moistening due to gluing process

- ✓ Warp control by using glue amount
- ✓ MD moisture variation due to speed changes

Drying due to needed temperature for gluing

- ✓ Heat is added other side than it is needed, Over drying
- ✓ MD moisture variation due to speed changes

Drying due to needed temperature for gluing

- ✓ Z-moisture difference
- ✓ Liner too dry for optimum gluing

Drying on the bridge

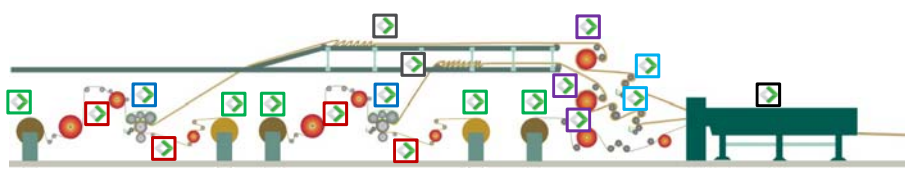
- ✓ MD moisture variation depending on production speed

Re-moistening due to gluing process

- ✓ Warp control by using glue amount

Drying to achieve final moisture levels


- ✓ One-sided drying
- ✓ High inertia



More than 10 drying & re-wetting cycles in corrugated board manufacturing process

Moisture control is a must especially with lightweight liners

3    26th September, 2018    © Valmet | PAPERmatters! 2018

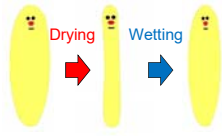
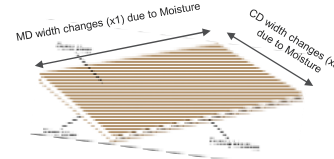




## Effect of fiber network behavior for corrugated board quality

Due to drying, fiber shrinks  
Due to wetting, fiber swells

Due to fiber anisotropy paper width 3 times more in the CD than in the MD


Liner moisture effect to glue penetration




**CD-Warping**

- Wrong moisture levels of top and bottom liners



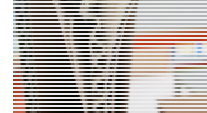
**S-Warping**

- Wrong CD moisture profiles of top and bottom liners



**Washboarding**


- Problems with glue dosing and wrong moisture level of liner



**Bad bonding**

- Problems with glue dosing and wrong moisture level of liner

4    26th September, 2018    © Valmet | PAPERmatters! 2018



## Valmet IQ Quality Control System for corrugators

### Paper machine based QCS for corrugators

- More sensors to give detailed on-line information from the process
- Fast actuators to reducing process limitations such as over-drying
- Comprehensive controls based on real measurements instead of recipe based running

● IQ Multipoint Moisture    
 ● IQ Moisturizer    
 ● IQ Converting Scanner    
 ● IQ Warp

5    26th September, 2018    © Valmet | PAPERmatters! 2018    **Valmet**

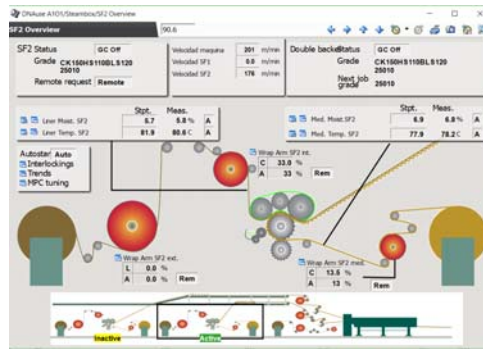
## Valmet IQ

### Benefits

Bonding	<ul style="list-style-type: none"> <li>• Stable and maximized bonding by optimized glue penetration inside the liners</li> </ul>	
Warping	<ul style="list-style-type: none"> <li>• Minimized warping tendency by correct moisture levels across the process</li> </ul>	
Washboard	<ul style="list-style-type: none"> <li>• Decreased washboard phenomena by optimum glue penetration and amount into the liners</li> </ul>	
Cracking	<ul style="list-style-type: none"> <li>• Eliminated cracking by correct moisture level of final product</li> </ul>	
Productivity	<ul style="list-style-type: none"> <li>• Faster grade changes and reduced waste</li> <li>• Higher corrugator and converting speed</li> <li>• Less manual intervention across corrugated board manufacturing process</li> </ul>	
Raw material savings	<ul style="list-style-type: none"> <li>• Possibility to decrease grammage of used liners</li> <li>• Glue savings due to optimum glue penetration</li> </ul>	<p>520 gsm    480 gsm</p>

## Combined moisture and temperature control at single facer

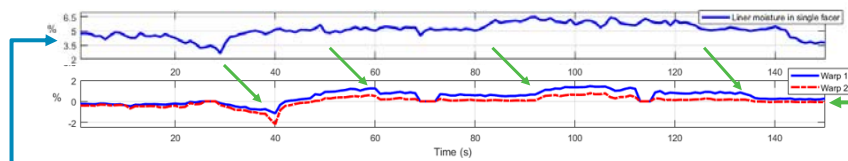
- Moisture of the coming papers varies due to
  - Changes in paper making process
  - Transportation condition
  - Storage condition
  - Weather and season
  - Corrugator process variation and changes
- Typically variation on the reel edges and on surface are the highest
  - Up to 4,0 % moisture changes



7 26th September, 2018 © Valmet | PAPERmatters! 2018



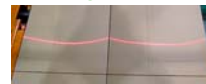
## Example of incoming paper moisture change to corrugated board warping



Variation in liner moisture



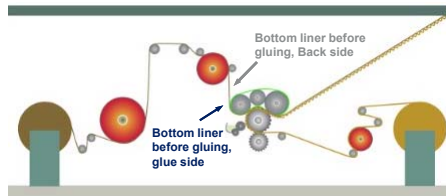
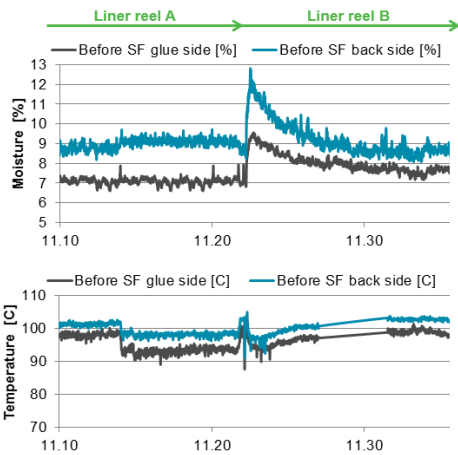
Corrugated board warping



8 26th September, 2018 © Valmet | PAPERmatters! 2018



## Liner moisture & temperature behavior at single facer



Big spike in moisture due to reel change

- Temperature increases due to improved heat transfer
- Operator makes wrong control decision

9 26th September, 2018 © Valmet | PAPERmatters! 2018



## Effect of bottom liner reel change

Stabilization time;

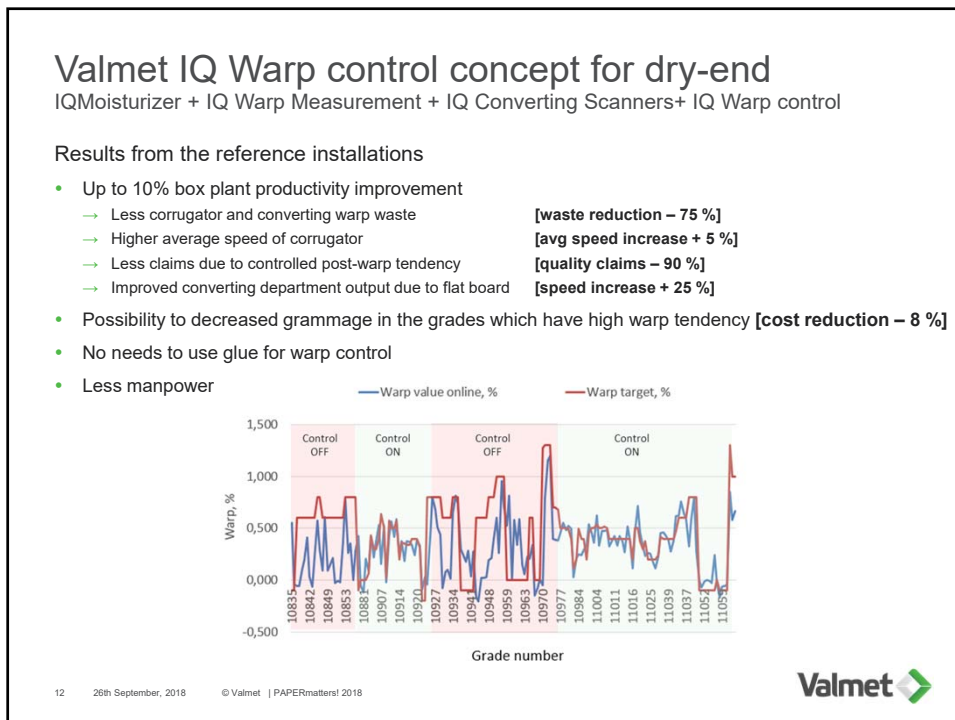
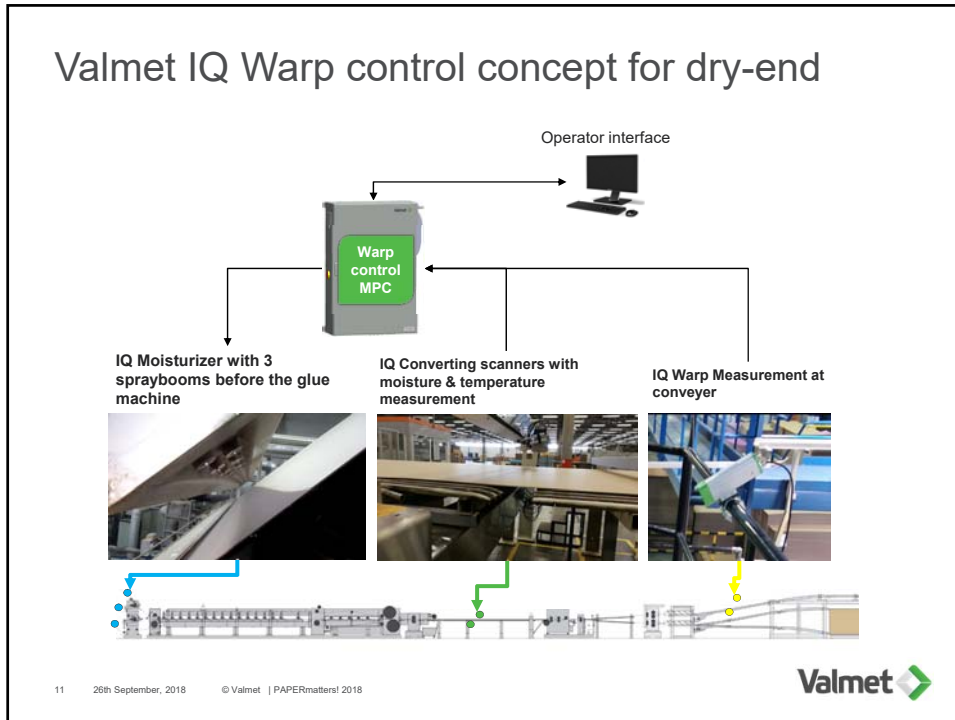
- With normal running, no control 7 min → 1,120 m
- With manual moisture control 1,5 min → 240 m
- With automatic moisture control 15 sec → 40 m

→ Improvement 96 %



10 26th September, 2018 © Valmet | PAPERmatters! 2018







## Return of Investment

### Savings from the reference installations

1. Warp waste reduction 75 % in corrugator, from 2,0 % to 0,5 %
  - Waste to prima 2 250 000 m<sup>2</sup>
  - Estimated cost of m<sup>2</sup> = 0,25 EUR
  - **Saving due to warp waste reduction 562 500 EUR**
2. Waste reduction in converting, from 2,4 % to 1,4 %
  - Waste to prima 1 500 000 m<sup>2</sup>
  - Estimated average cost of m<sup>2</sup> = 0,25 EUR
  - **Saving due to converting waste reduction 375 000 EUR**

#### Production information prior Valmet IQ

Plant	Corrugator in EU
Machine	BHS
Annual Production	150 000 000 m <sup>2</sup>
Line Speed (fpm)	350 m/min
B Flute	40 %
C Flute	50 %
E Flute	2 %
D/W	8 %
Basis weight	530 g/m <sup>2</sup>
Total waste	13 %
Customer Paid	4 %
Trim	3,60 %
Converting	2,40 %
Warp	2 %
Delam	1 %

#### Other benefits

- Improved converting department output due to flat board
- Less claims due to controlled post-warp tendency
- Higher average speed of corrugator
- Possibility to decreased grammage in the grades which have high warp tendency
- No needs to use glue for warp control
- Less manpower

13 26th September, 2018 © Valmet | PAPERmatters! 2018



## IQ Moisturizer for warp elimination

### Major corrugated board manufacturer in Europe

#### Background

- A major corrugator producer wants to decrease amount of waste and improve productivity
  - Warp & S-warp waste reduction
  - Reduce paper weight
  - Increase production speed and converting line efficiency
- Corrugator: Wet-end Agnatti, Dry-end BHS / Marquip
- Production: 70 % agribusiness (wines, fresh food.), 15 % industry, 15 % e-commerce
- 6 flutes: B, C, P, BP, EP & BC

#### Valmet solution

- Three Valmet IQ Moisturizers for warp control of their corrugated board were installed in March 2016



#### Results

- **Corrugator waste due to warp (m<sup>2</sup>)**
  - 2015 July/Aug 173,000 m<sup>2</sup>
  - 2016 July/Aug 86,000 m<sup>2</sup>
- **Average speed of converting**
  - 2015 July/Aug 3,587 sheet/hour
  - 2016 July/Aug 4,324 sheet/hour
- **Converting waste**
  - 2015 July/Aug 3,09 %
  - 2016 July/Aug 1,02 %
- **Production speed and costs**
  - Corrugator speed increase
  - Production cost

- 50 %  
- Annual savings 300 000 €

+ 21 %

- 67 %

+ 5 %

- 8 %



14 26th September, 2018 © Valmet | PAPERmatters! 2018

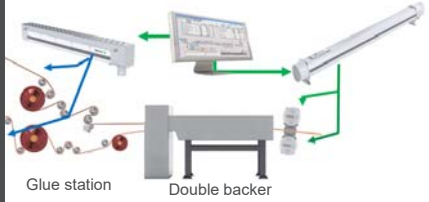


## Valmet IQ warp control concept

### Results from reference installation

**Background:**

- A major corrugator producer wanted to minimize warp and washboard reject in BHS Corrugator from 1991
  - CD-warp, S-warp, Post-warp
- Production
  - all kinds of combinations of liner and fluting qualities, such as bleached and unbleached kraftliner, white top liner, testliner, coated liner and semi-chemical fluting

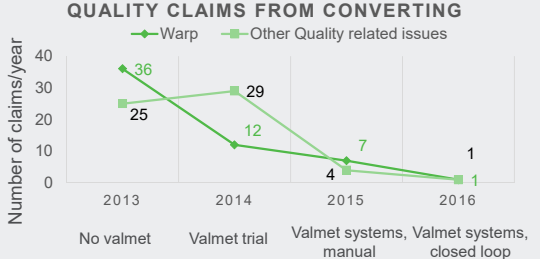


Glue station      Double backer

**Valmet Solution**

- Two one-sided scanners with IR moisture & temperature sensors after double backer
- Two moisturizers on the glue station
- Closed loop control for inner & outer liners

**QUALITY CLAIMS FROM CONVERTING**




Year	Warp	Other Quality related issues
2013	36	25
2014	12	29
2015	4	7
2016	1	1

Number of claims/year

2013      2014      2015      2016


No valmet      Valmet trial      Valmet systems, manual      Valmet systems, closed loop

15    26th September, 2018    © Valmet | PAPERmatters! 2018



## Corrugator process in the future

- The time between paper production and conversion of paper reels is important
  - Smart reels, traceability
- Taking care of weather impact
  - Seasons, geographical location
- Eliminate variation of paper properties like moisture, temperature, strength in corrugator process
  - Corrugator QCS
- Prediction of performance packaging already in papermaking process
  - Feedback of the bad quality back to the paper manufacturing



16    26th September, 2018    © Valmet | PAPERmatters! 2018

