Building Leadership Excellence

people resources solutions

New Insights into Gap Forming of Lightweight Containerboard

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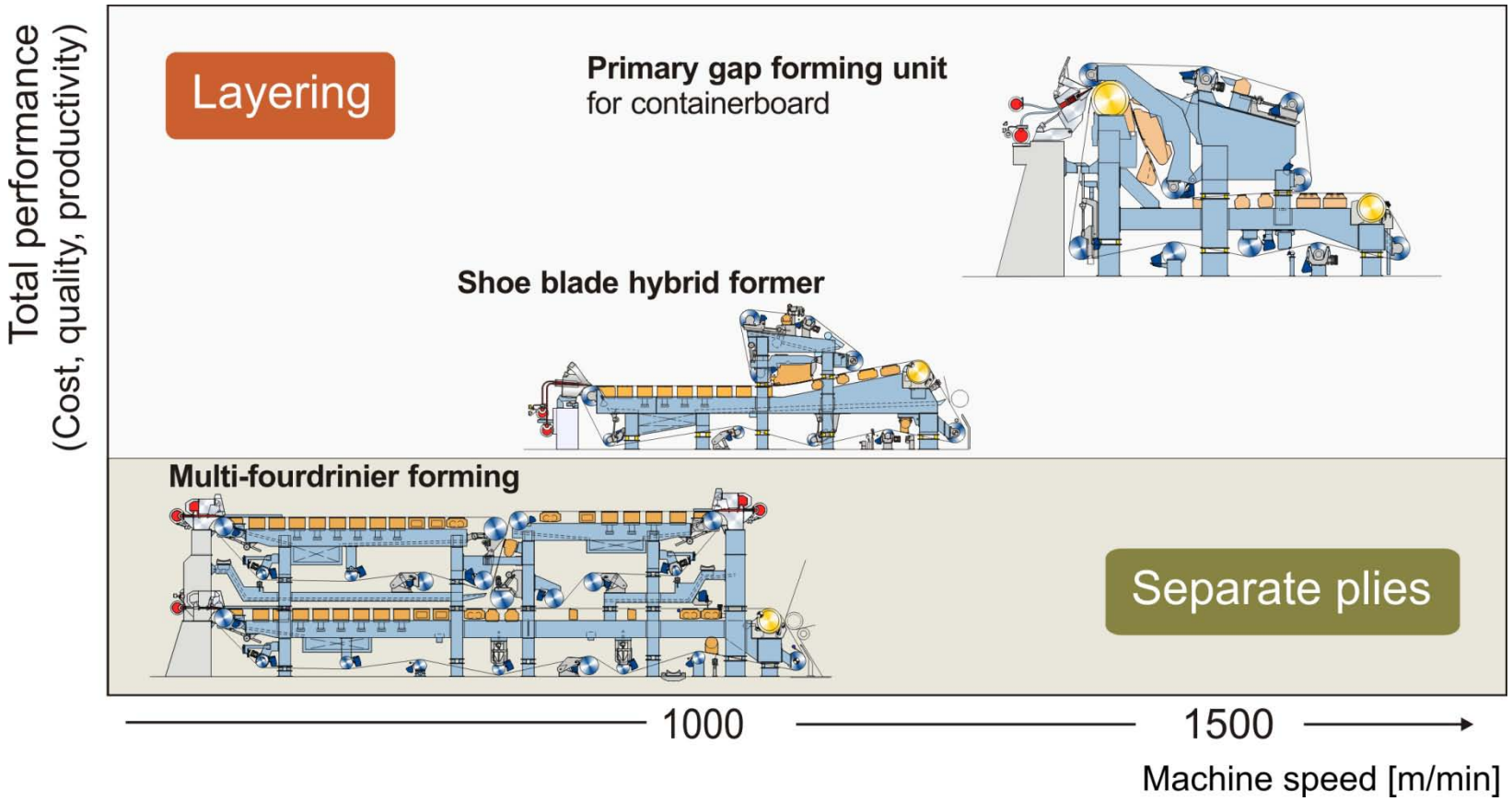
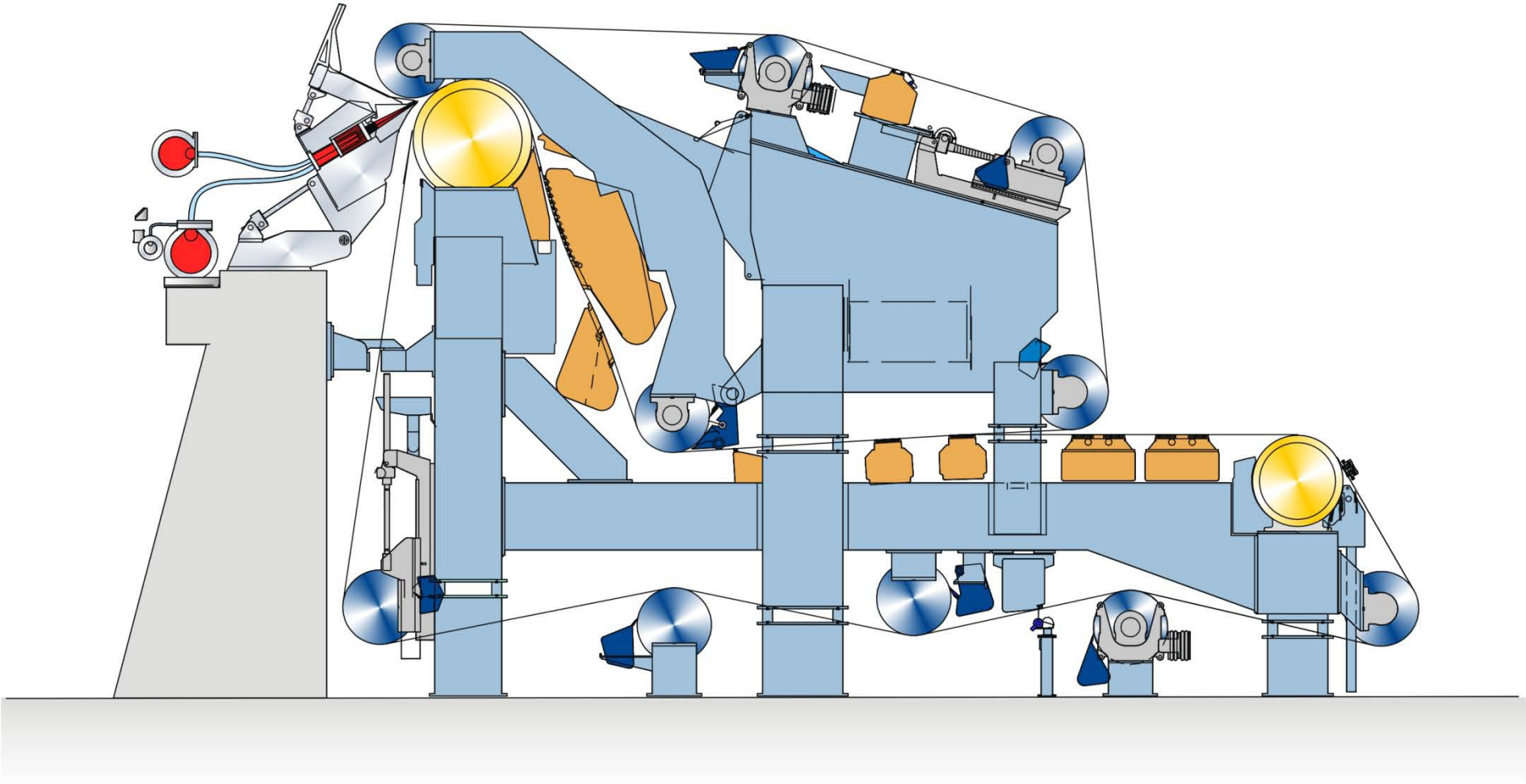
Metso, Paper business line

Concepts for forming



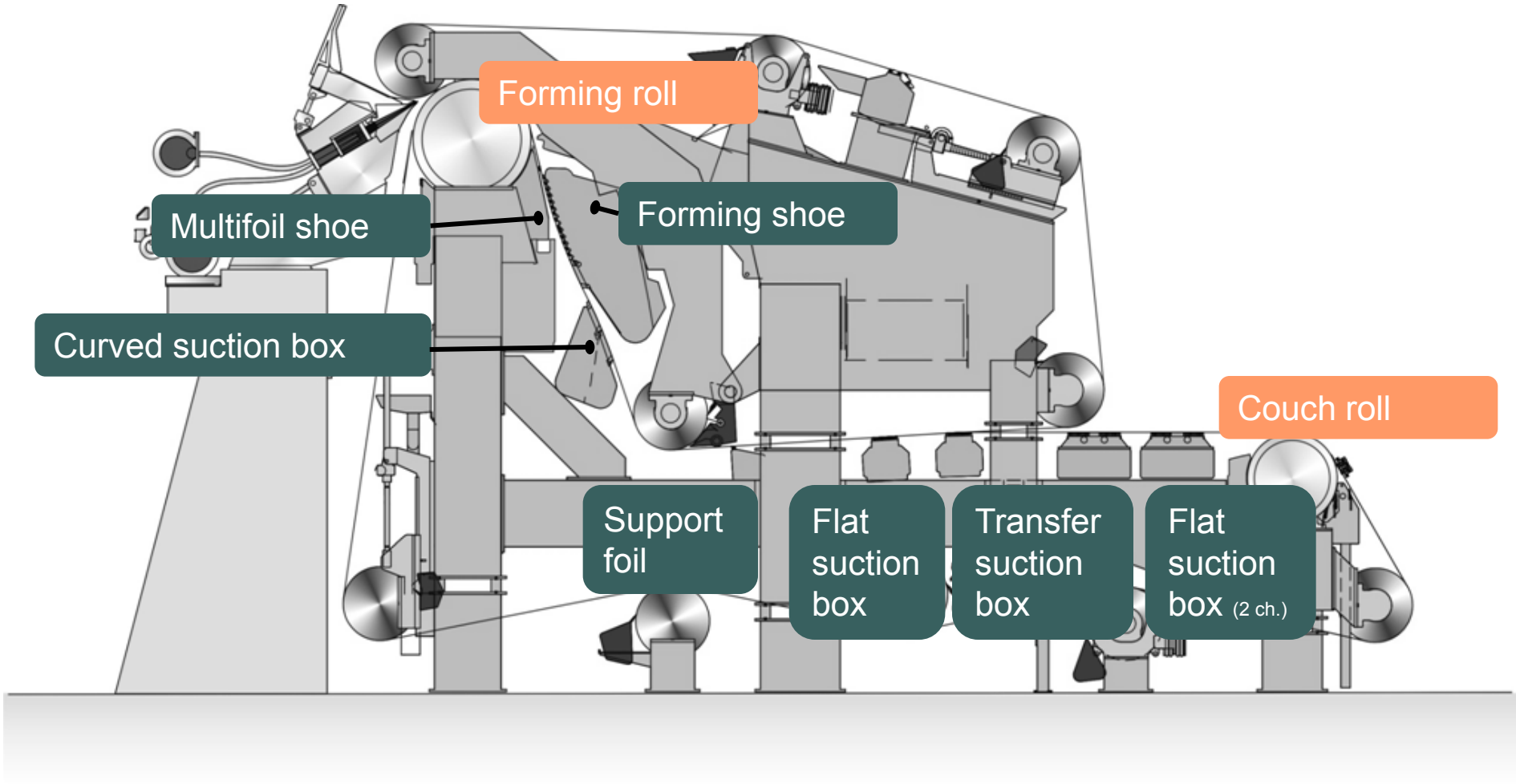
Gap former with two-layer headbox

High-open volume forming roll design



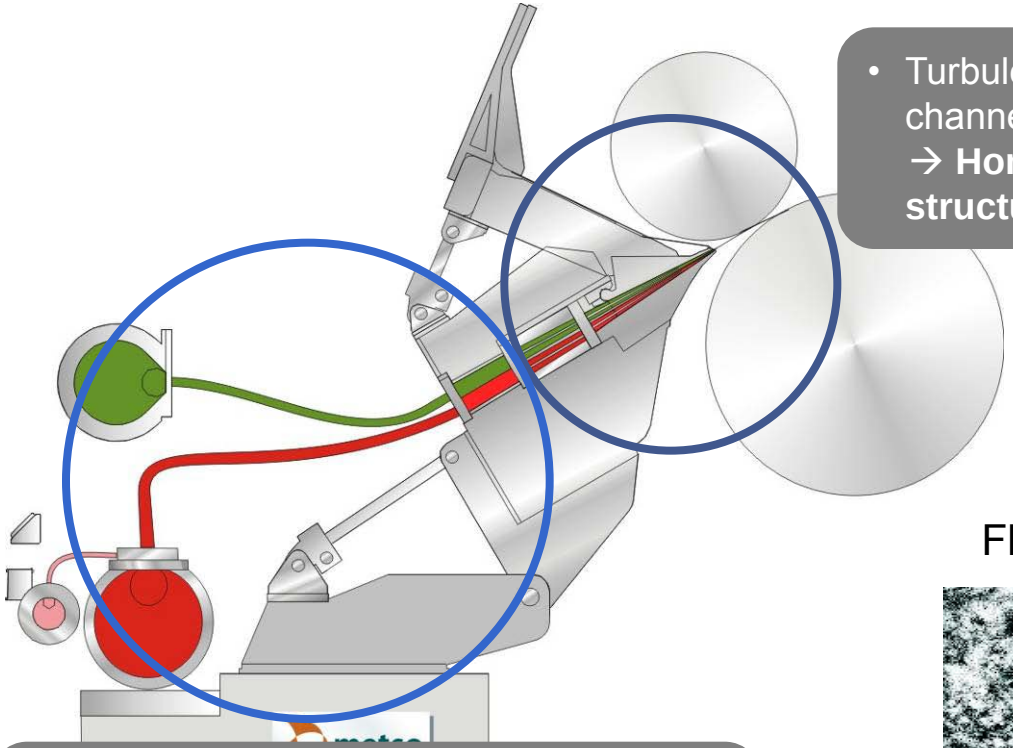
Gap former with two-layer headbox

Dewatering elements



High-performance two-layer headbox

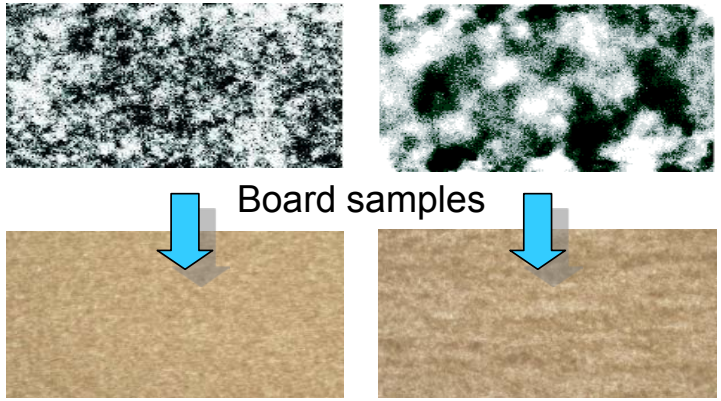
Fluidized state in headbox slice jet



- Turbulence generator and slice channel area with wedge technology → **Homogeneity of board structure**

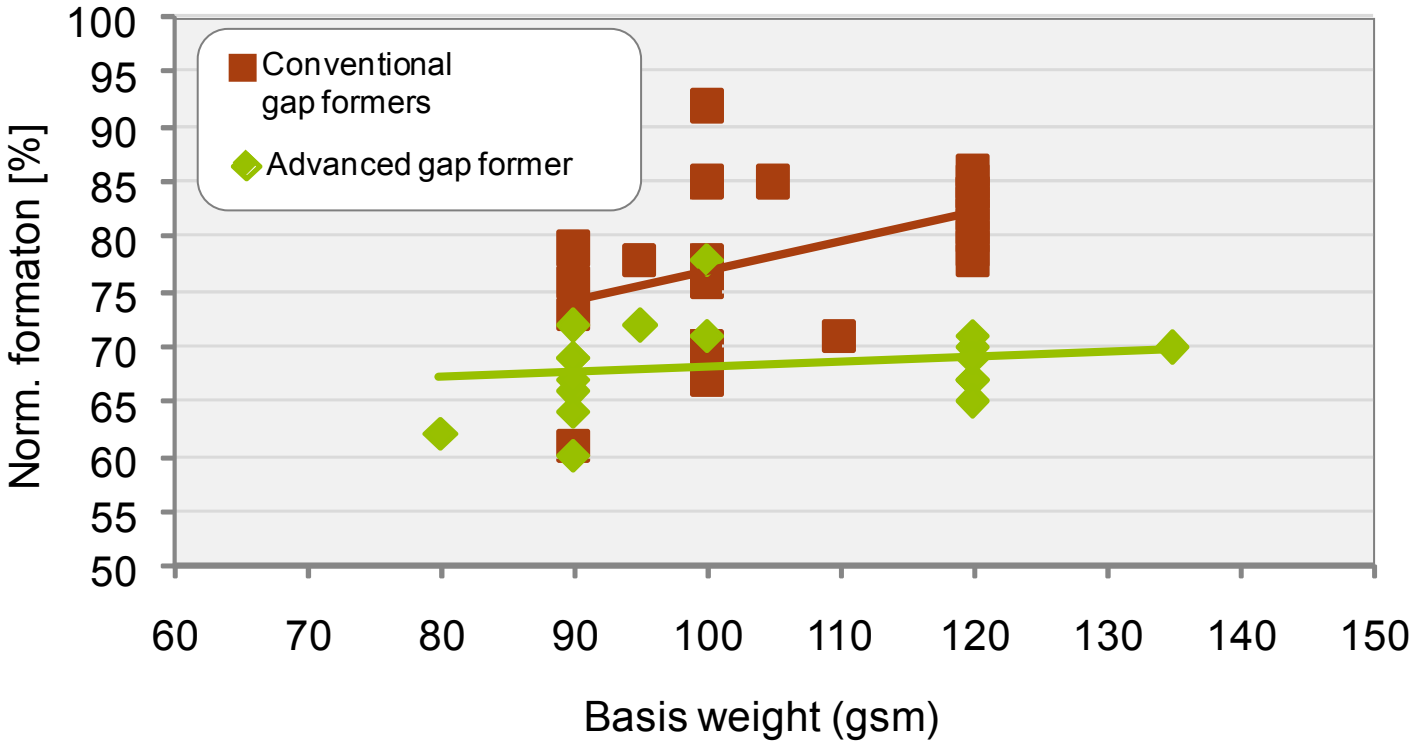
- Dilution principle
- Side/edge flows
- Shape-optimized header → **Even profiles**

Fluidized state in headbox slice jet



Formation comparison

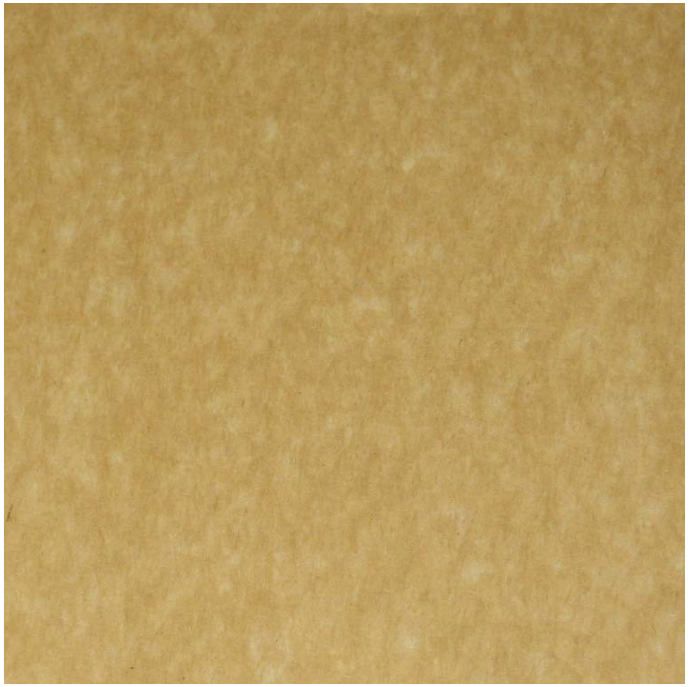
Advanced former concept to conventional gap former designs



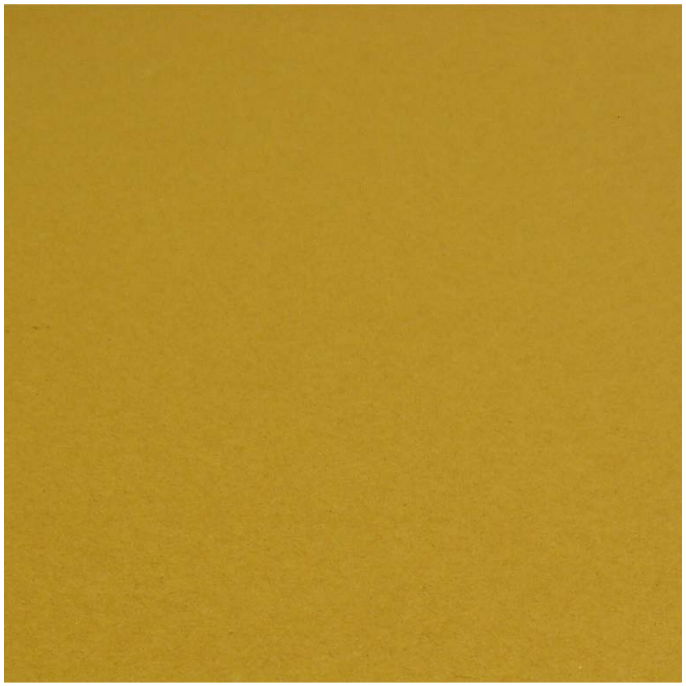
New high-performance two-layer headbox

Layer coverage

- Poor fluidization, non optimized geometry (extra steps, “parrot beak” slice lips etc.) and speed difference between layers destroy layer coverage

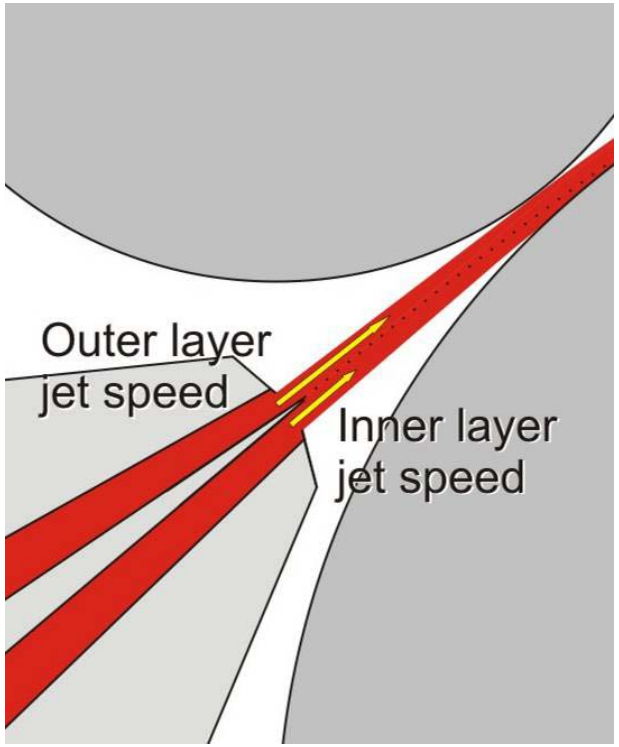


- Optimized technology of the new high-performance two-layer headbox delivers good layer coverage without disturbing streaks



Rigid separating element two-layer headbox

- Literature references concerning
  - Two-layer rigid separating element headbox and strength properties
  - Higher strength properties (geom. tensile strength, SCT_{CD}, $RCT_{CD)}$ achieved if the outer layer runs at a higher speed than the inner layer

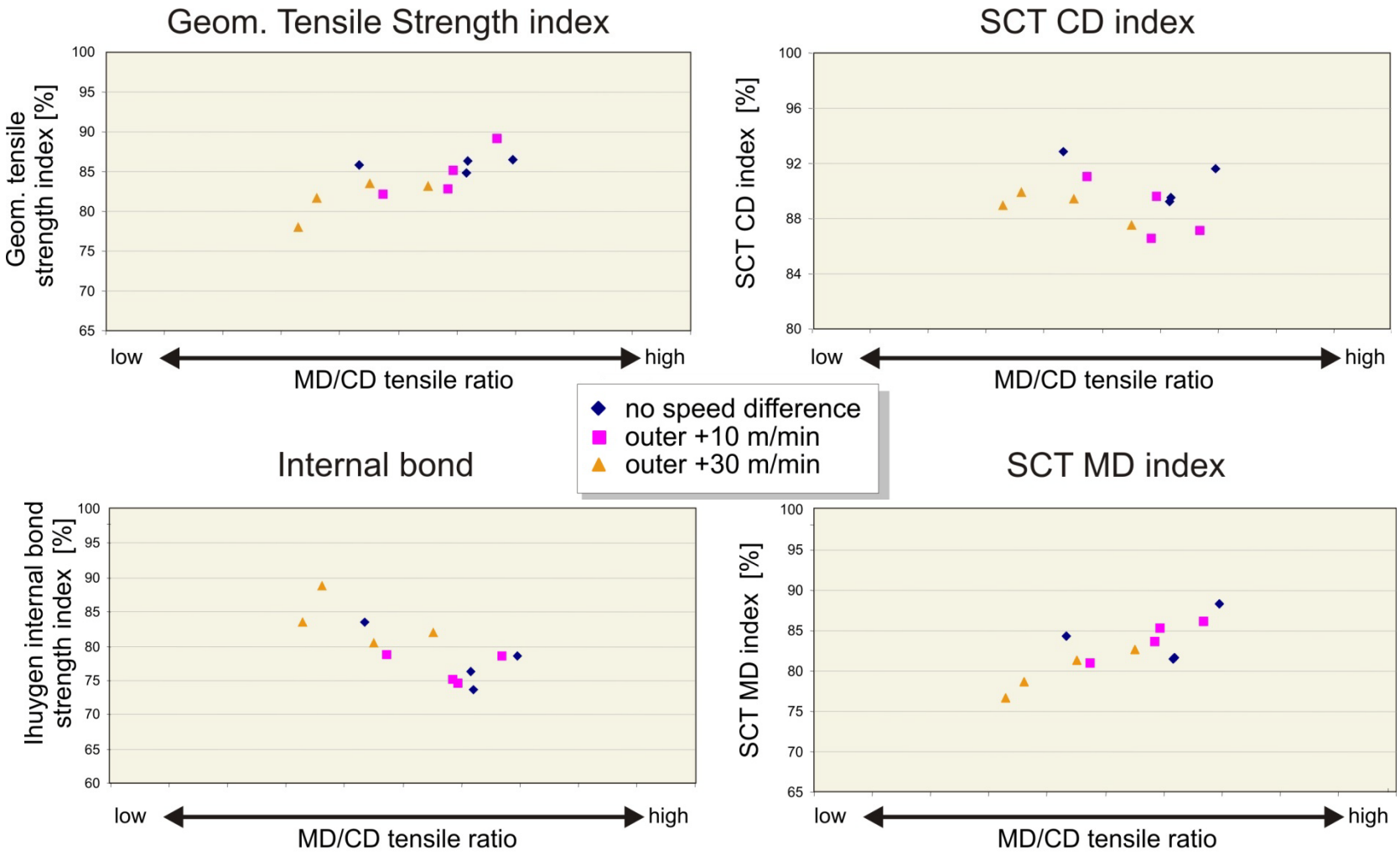


The outer layer runs at a higher speed than the inner layer.

Geom. Tensile Strength index = $\left(\sqrt{\text{tensile index}_{MD} * \text{tensile index}_{CD}}\right)$

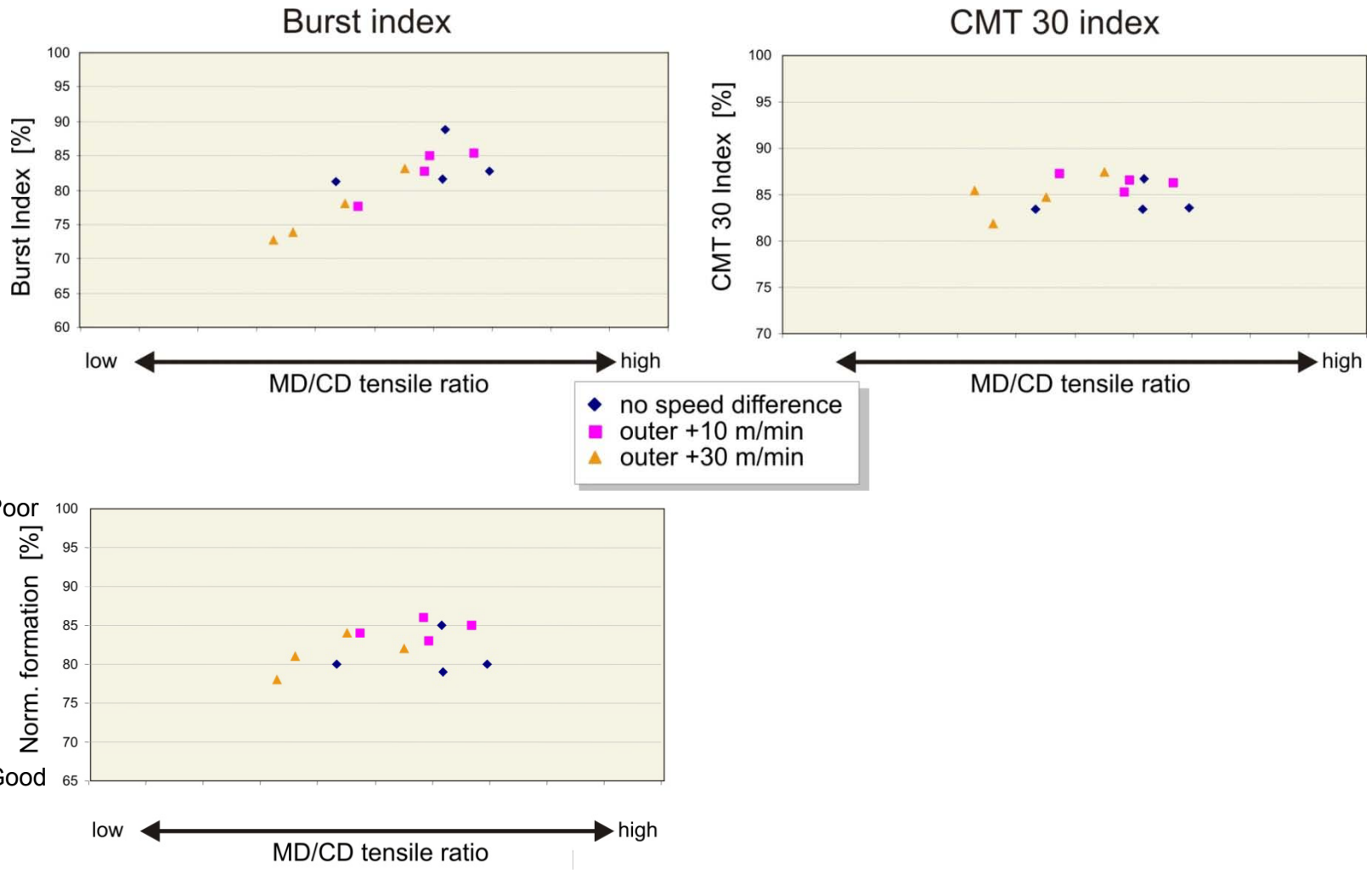
Main strength properties

Test with rigid separating element two-layer headbox



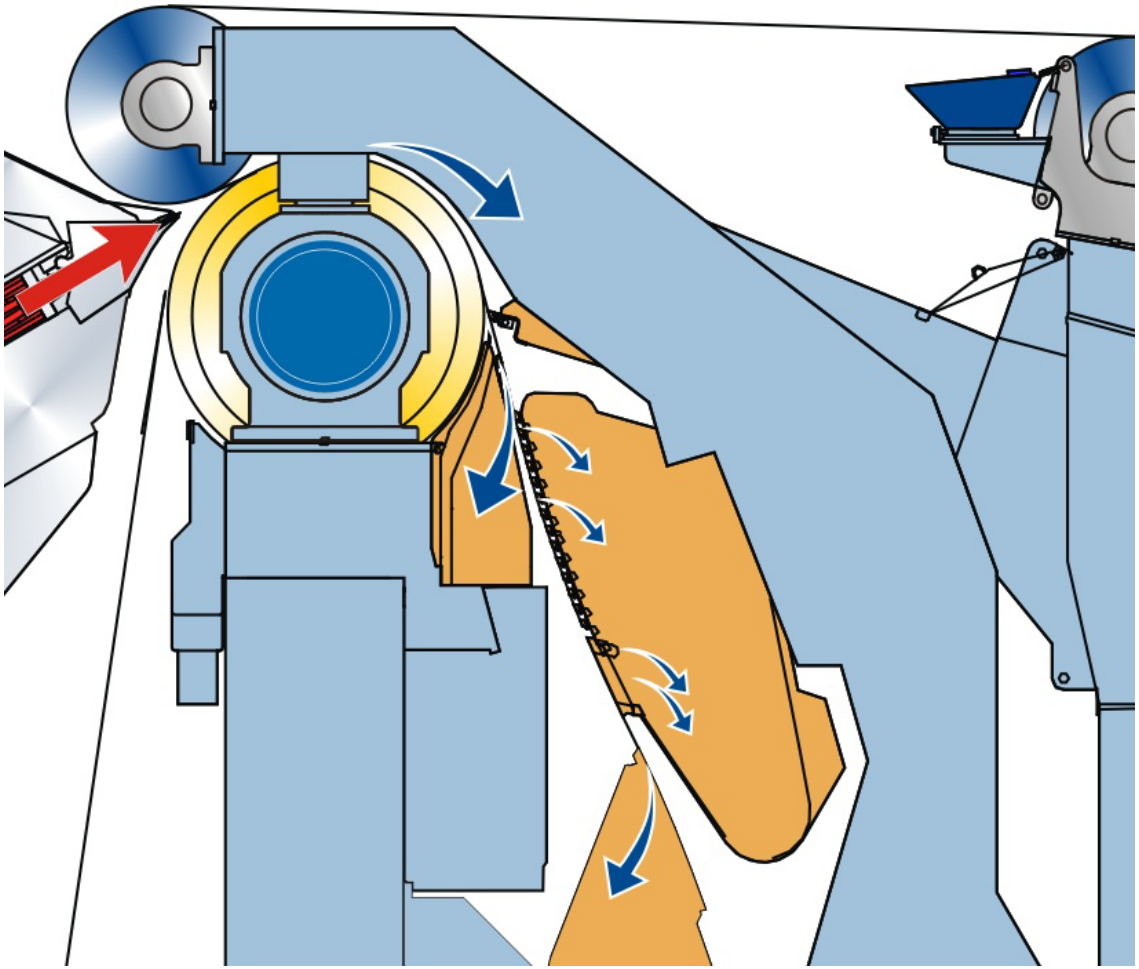
Other strength properties

Test with rigid separating element two-layer headbox

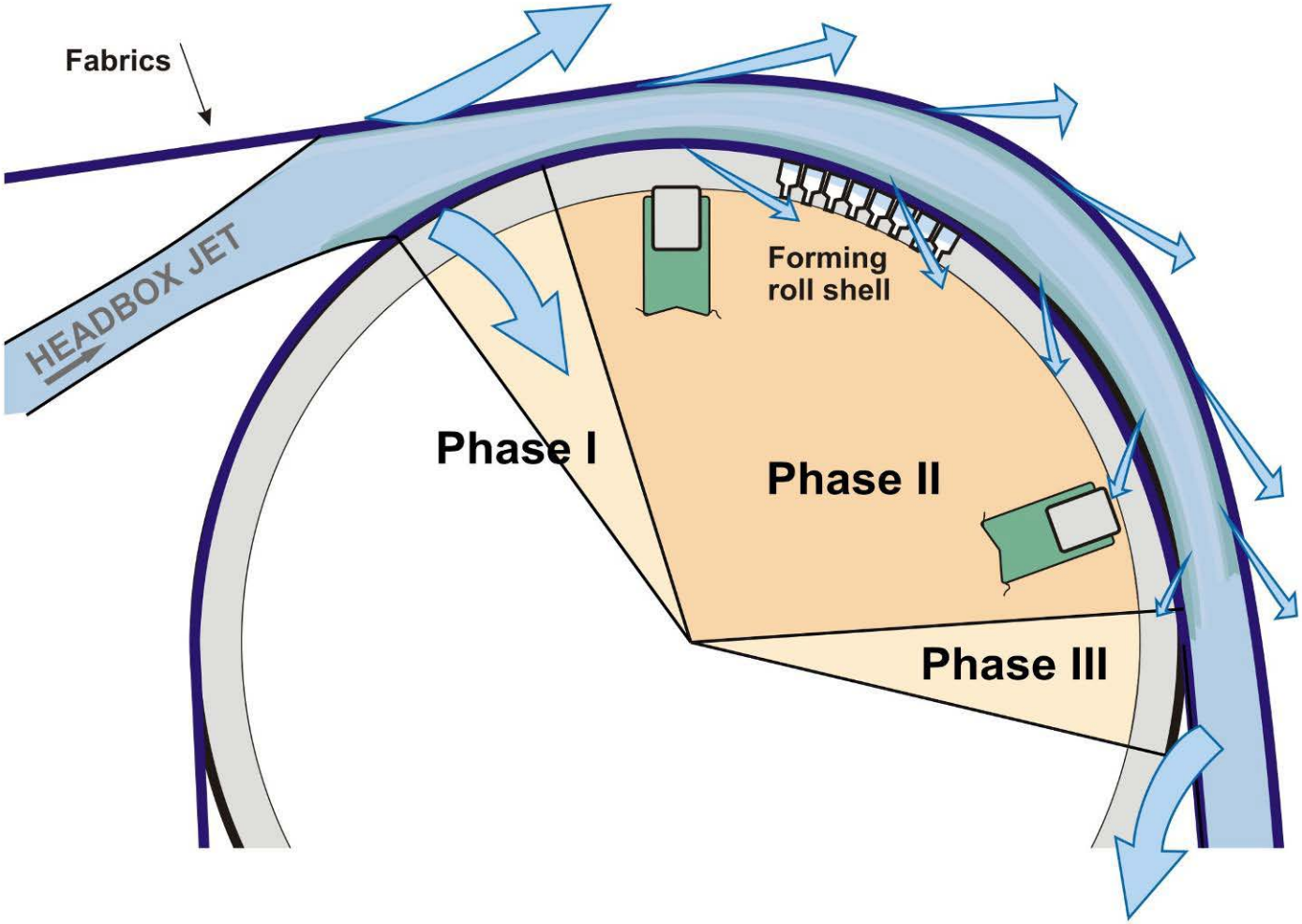


Gap former configuration for containerboard

Forming zone



Forming roll drainage process



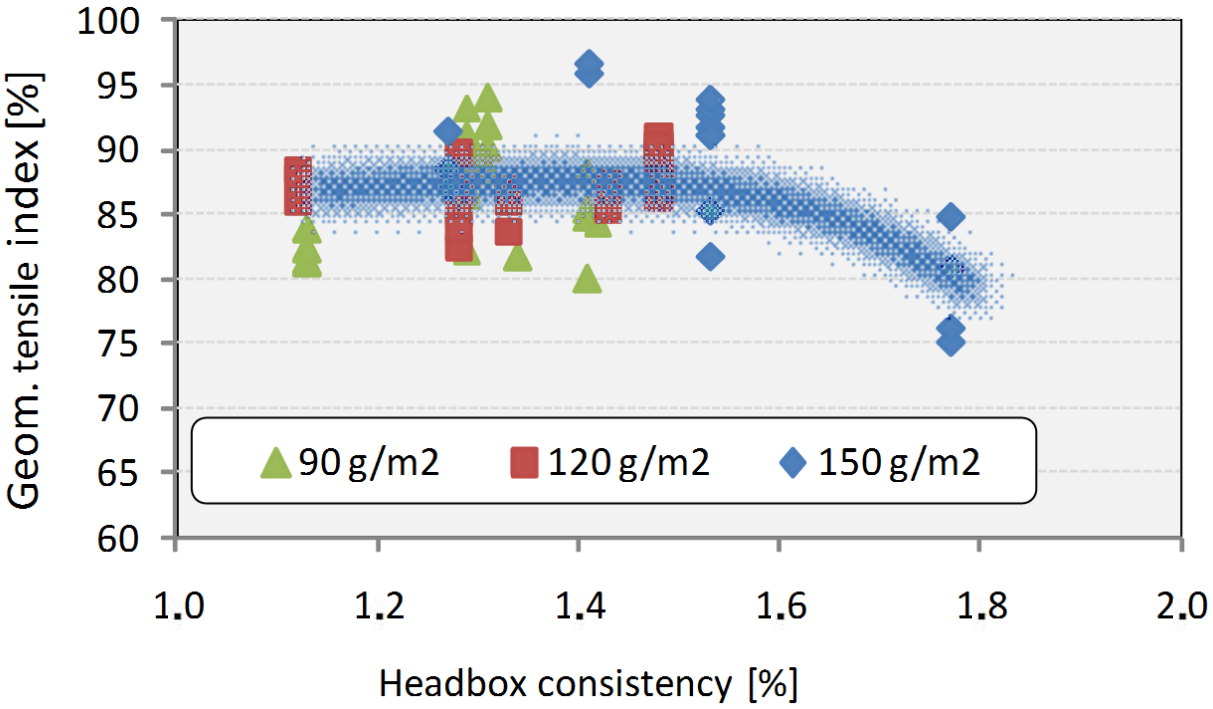
Produced board grades, machine speeds and production rates – Table 1

Grade [g/m²]	Reel speed [m/min]	Production rate [t/m*h]
90	1550, 1750	8.4 – 9,5
120	1250, 1550	9.0 – 11.2
150	1250	11.2

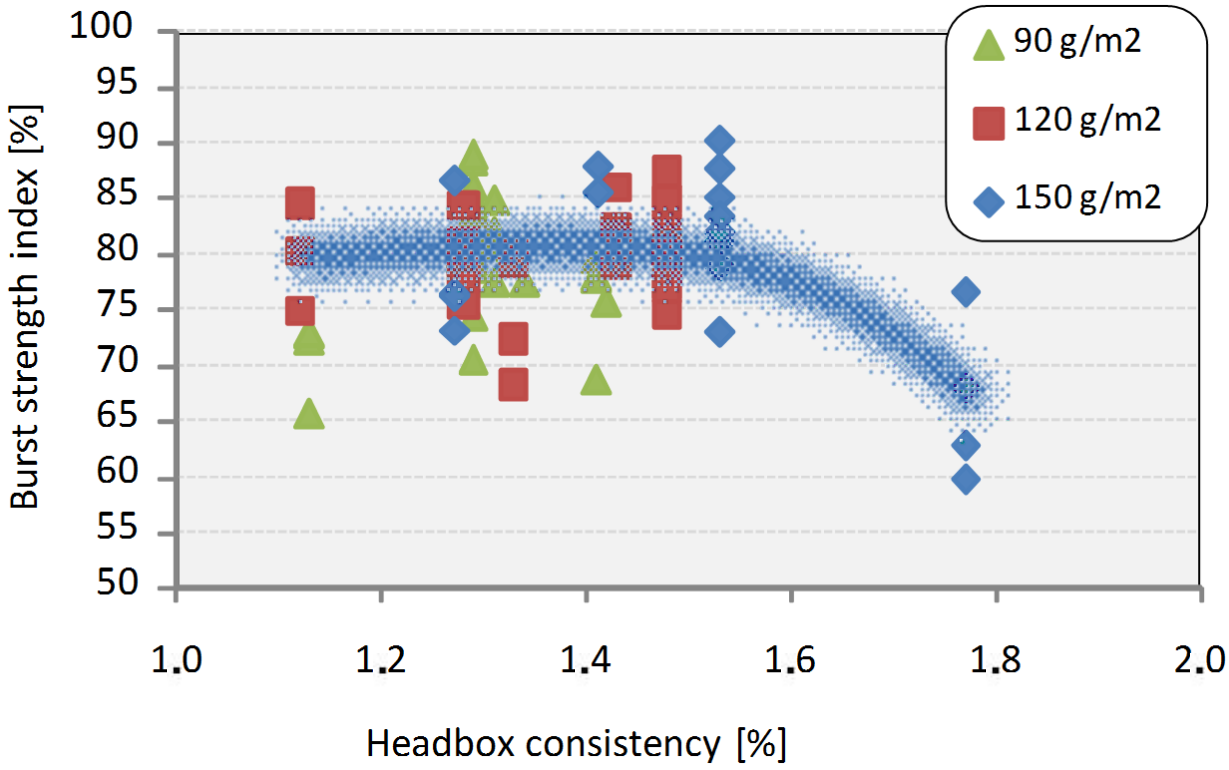
Effect of lower headbox consistency on board properties – Table 2

Property	Effect of lower headbox consistency
Pumping costs	Increase
Retention	Decrease
Tensile and burst strength	No effect below 1.5 %
Internal strength	Decrease

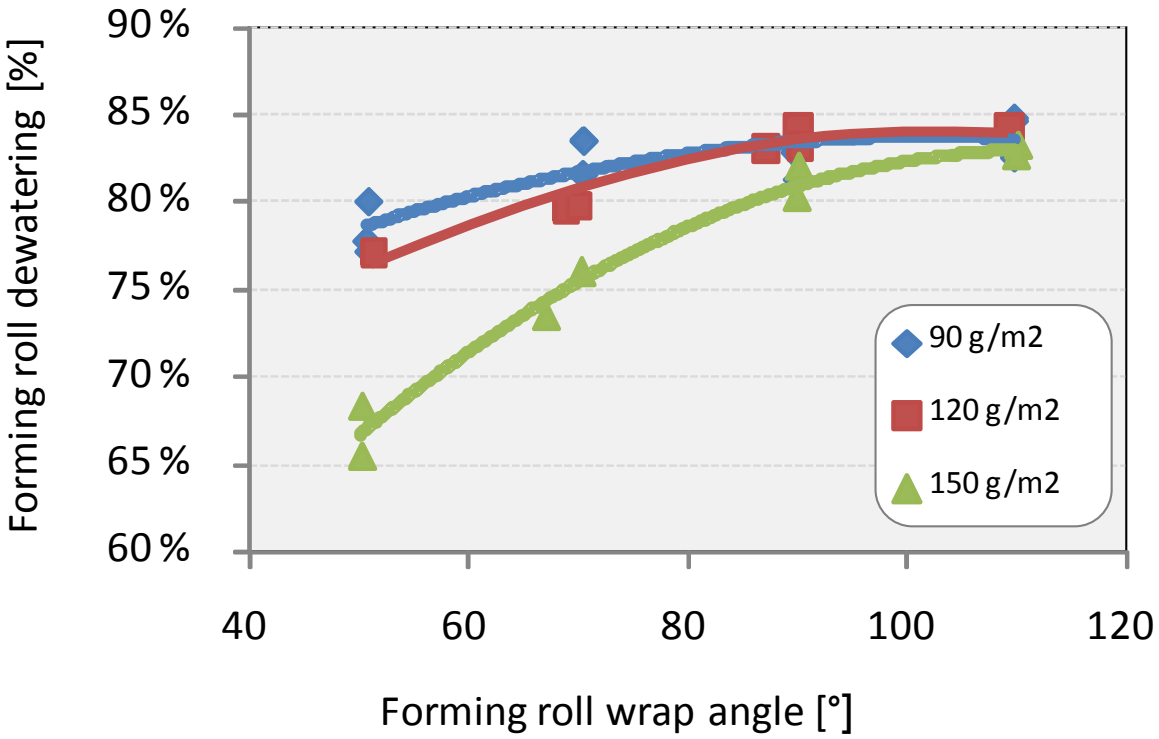
Effect of total headbox consistency on in-plane tensile strength



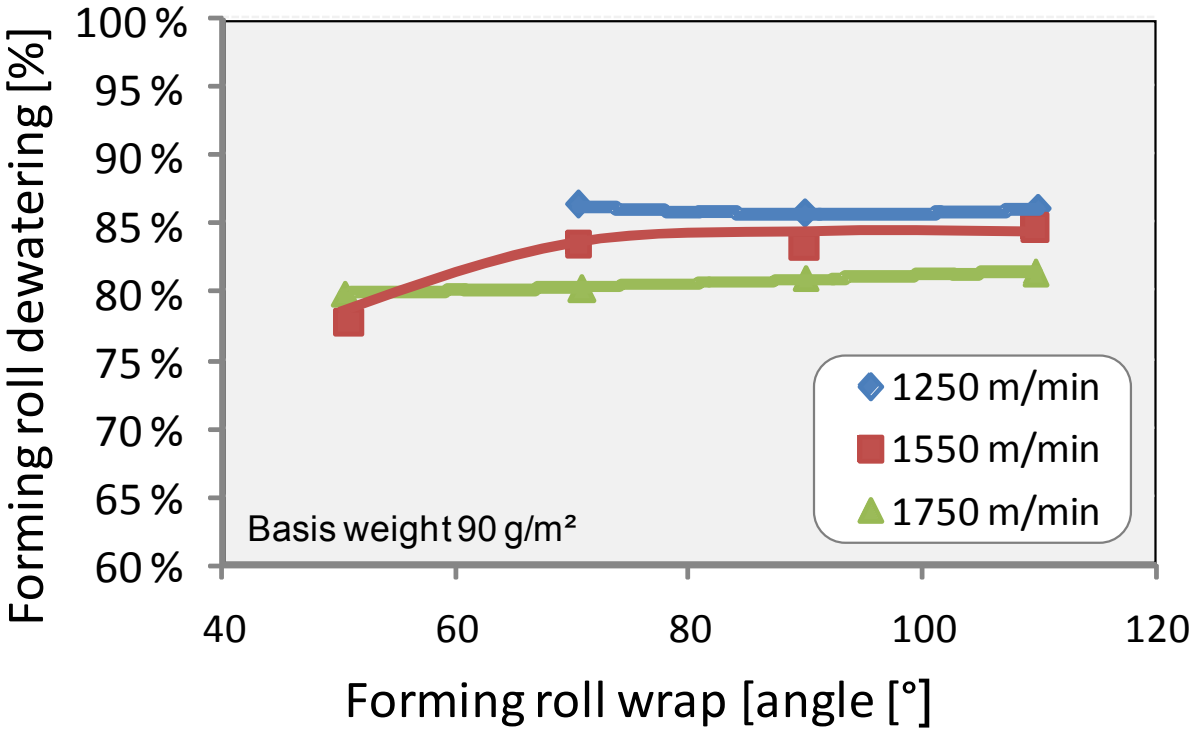
Effect of total headbox consistency on in-plane burst strength



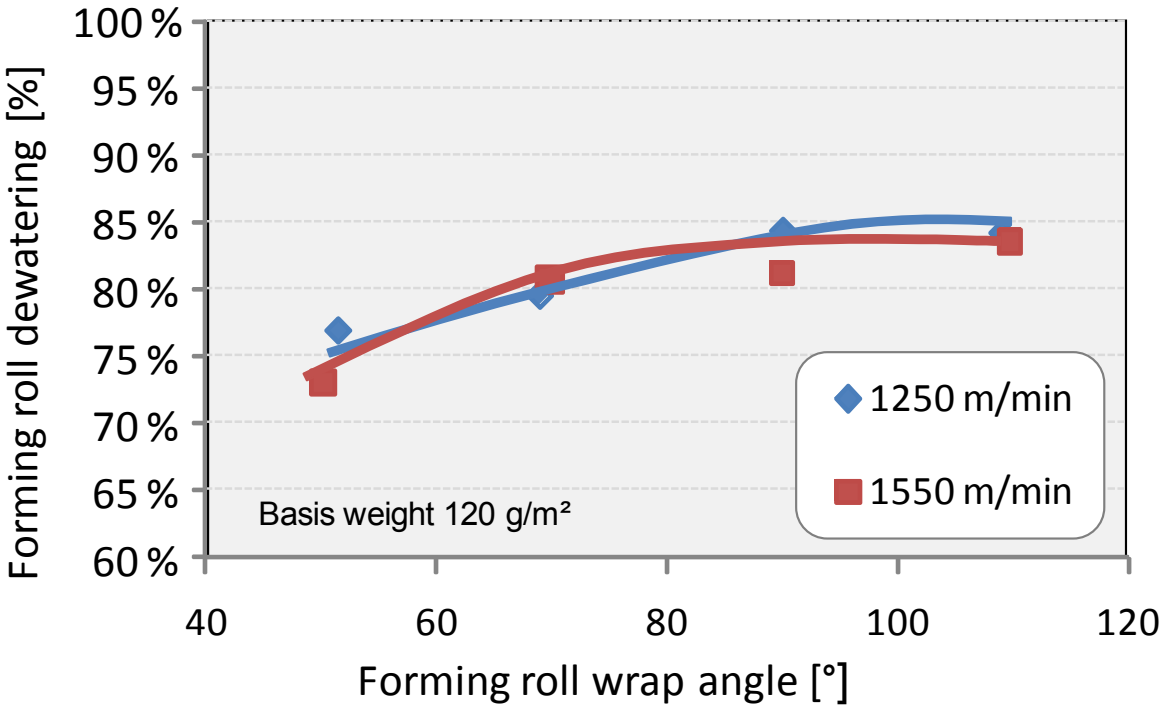
Effect of forming roll wrap angle on drainage



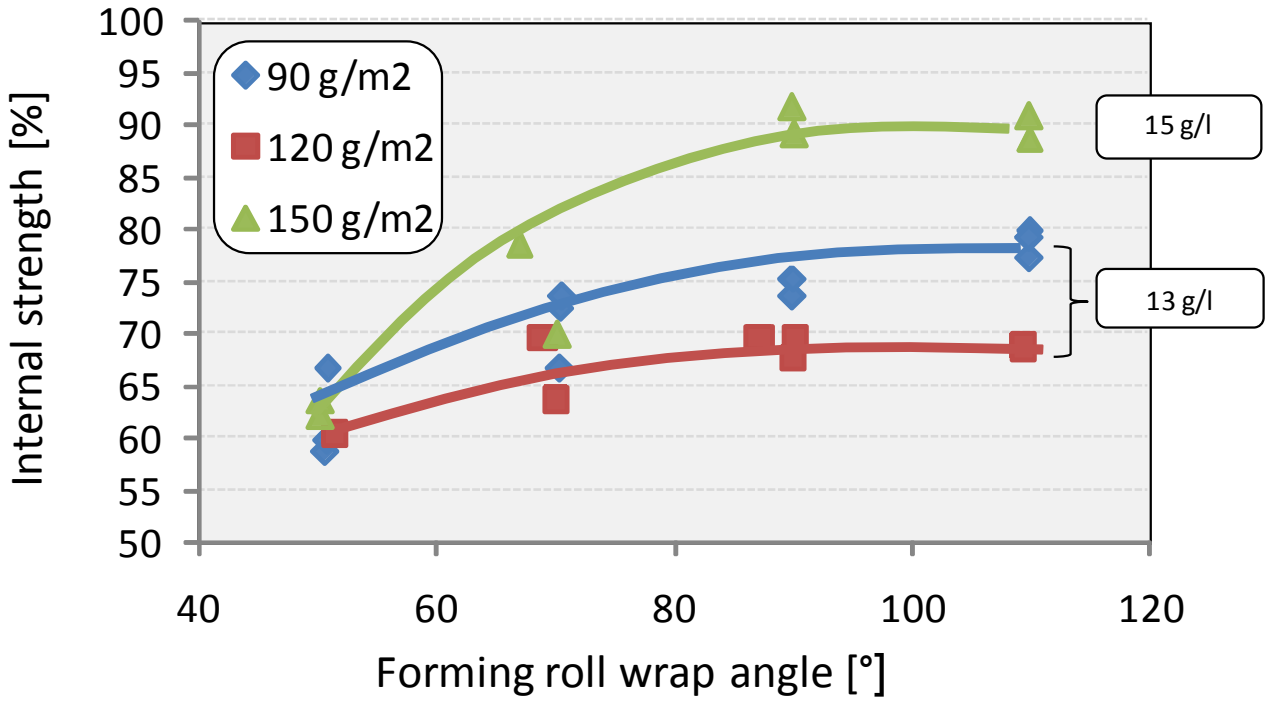
Effect of machine speed on the proportion of forming roll dewatering with 90 g/m²



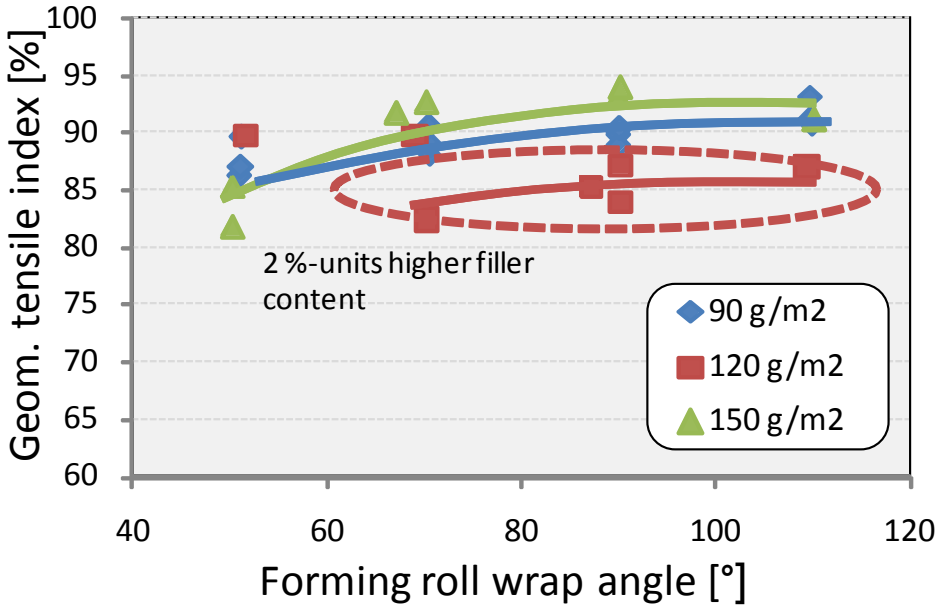
Effect of machine speed on the proportion of forming roll dewatering with 120 g/m²

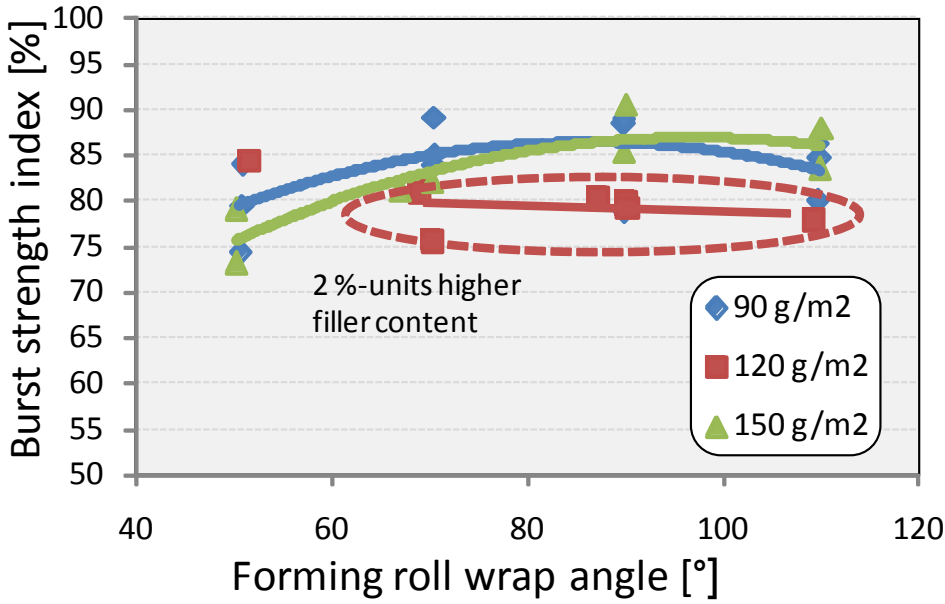


Internal strength as a function of forming roll wrap angle

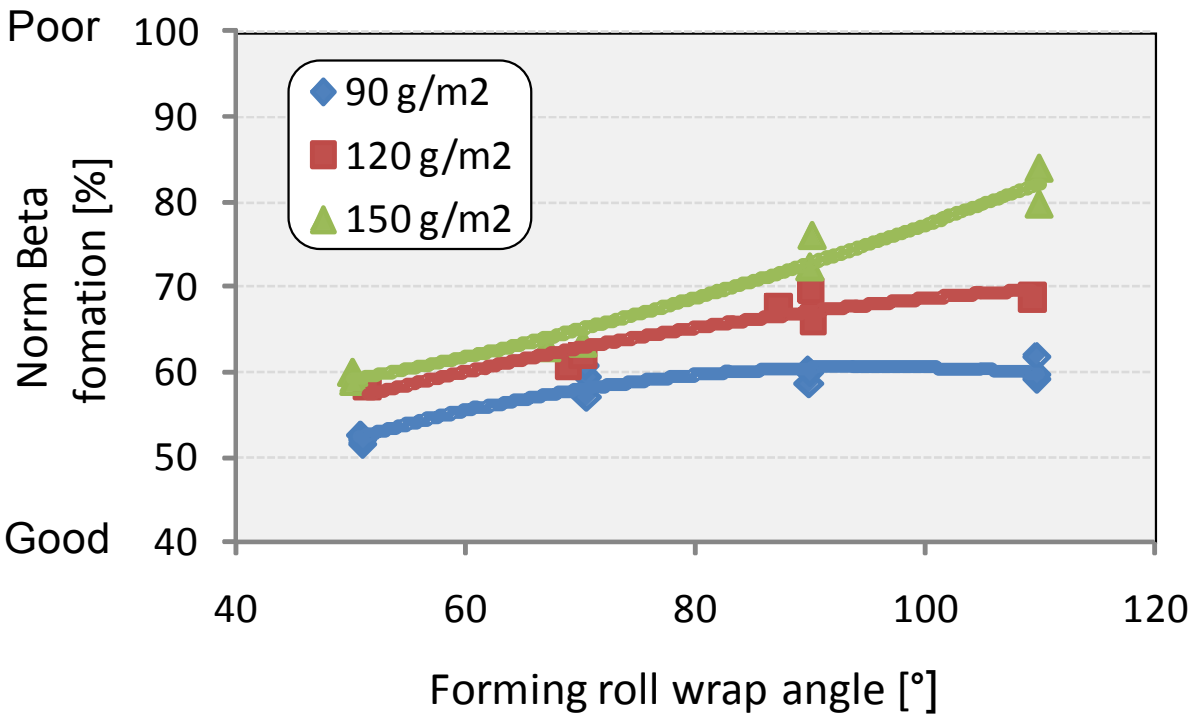


Geometrical tensile index as a function of forming roll wrap angle



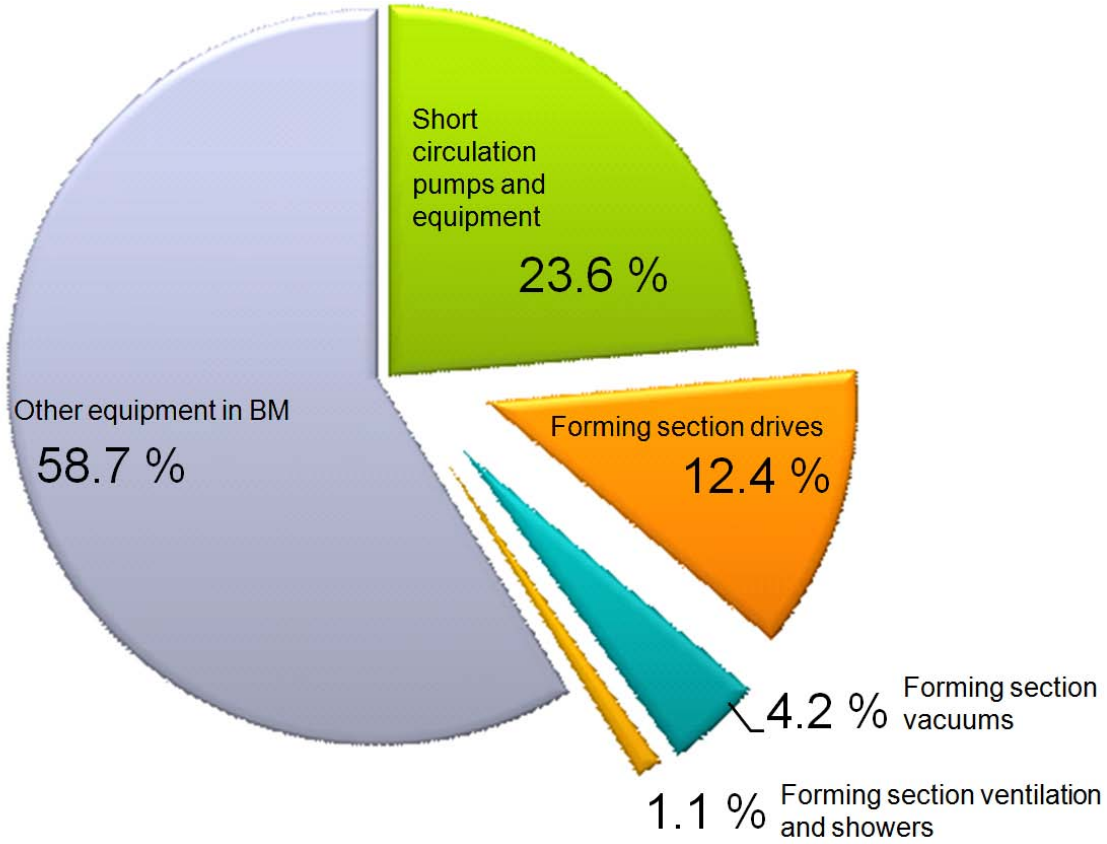


Effect of forming roll wrap angle on beta formation



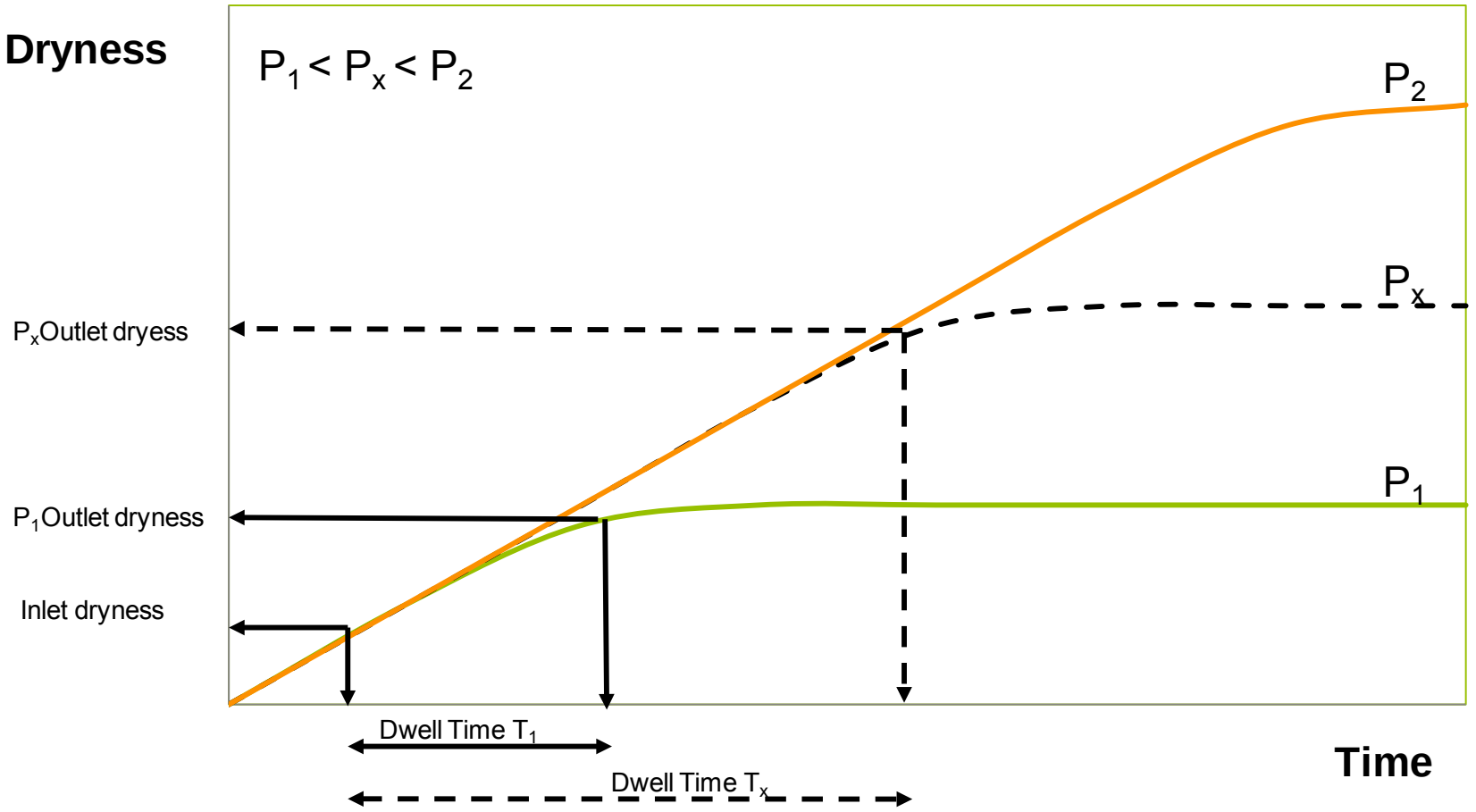
Typical power demand distribution of a high speed containerboard machine

Production machine data



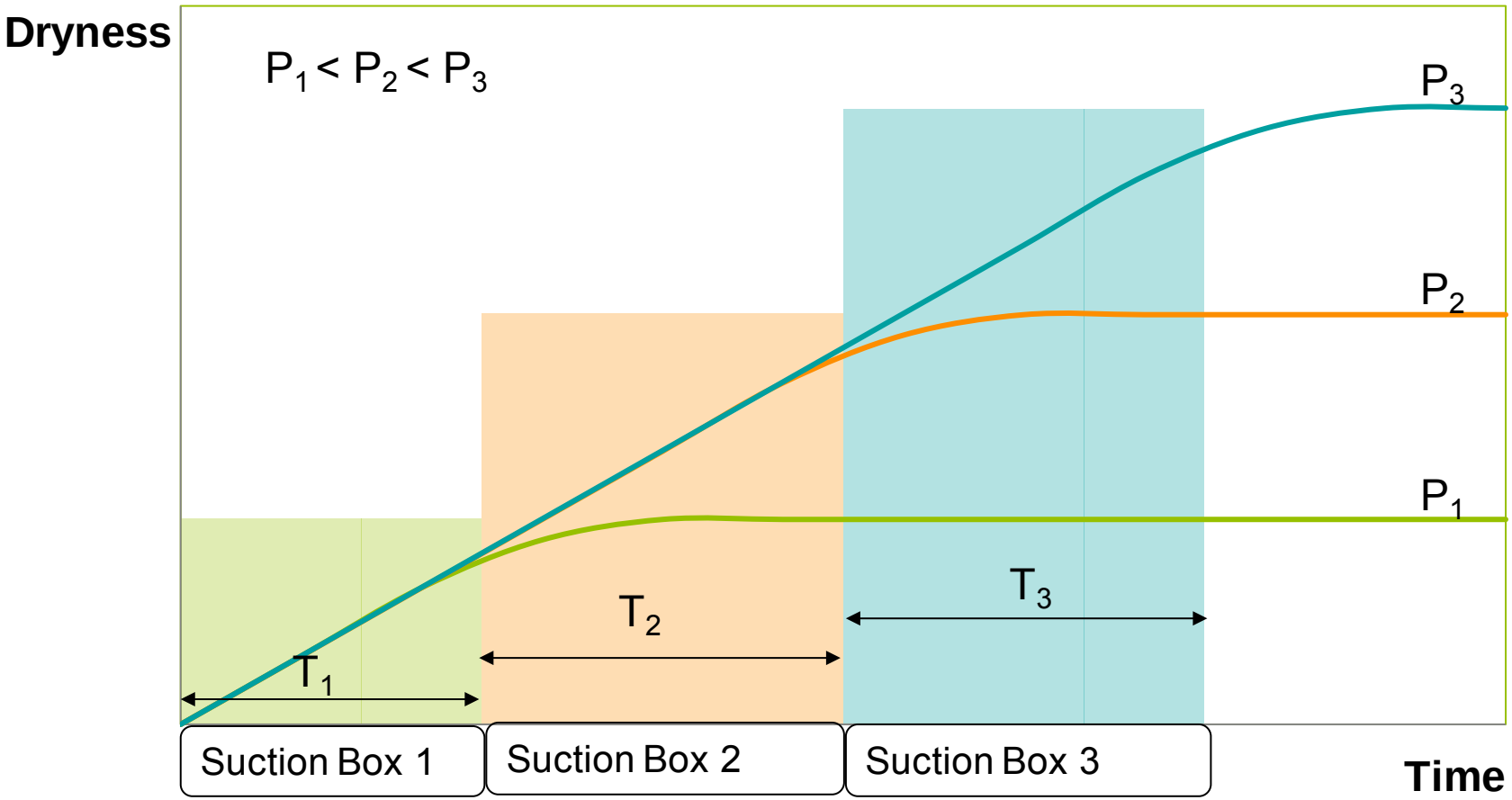
Dryness increase versus dwell time

Forming section



Optimized scaling of suction box vacuums

Containerboard machine, production data



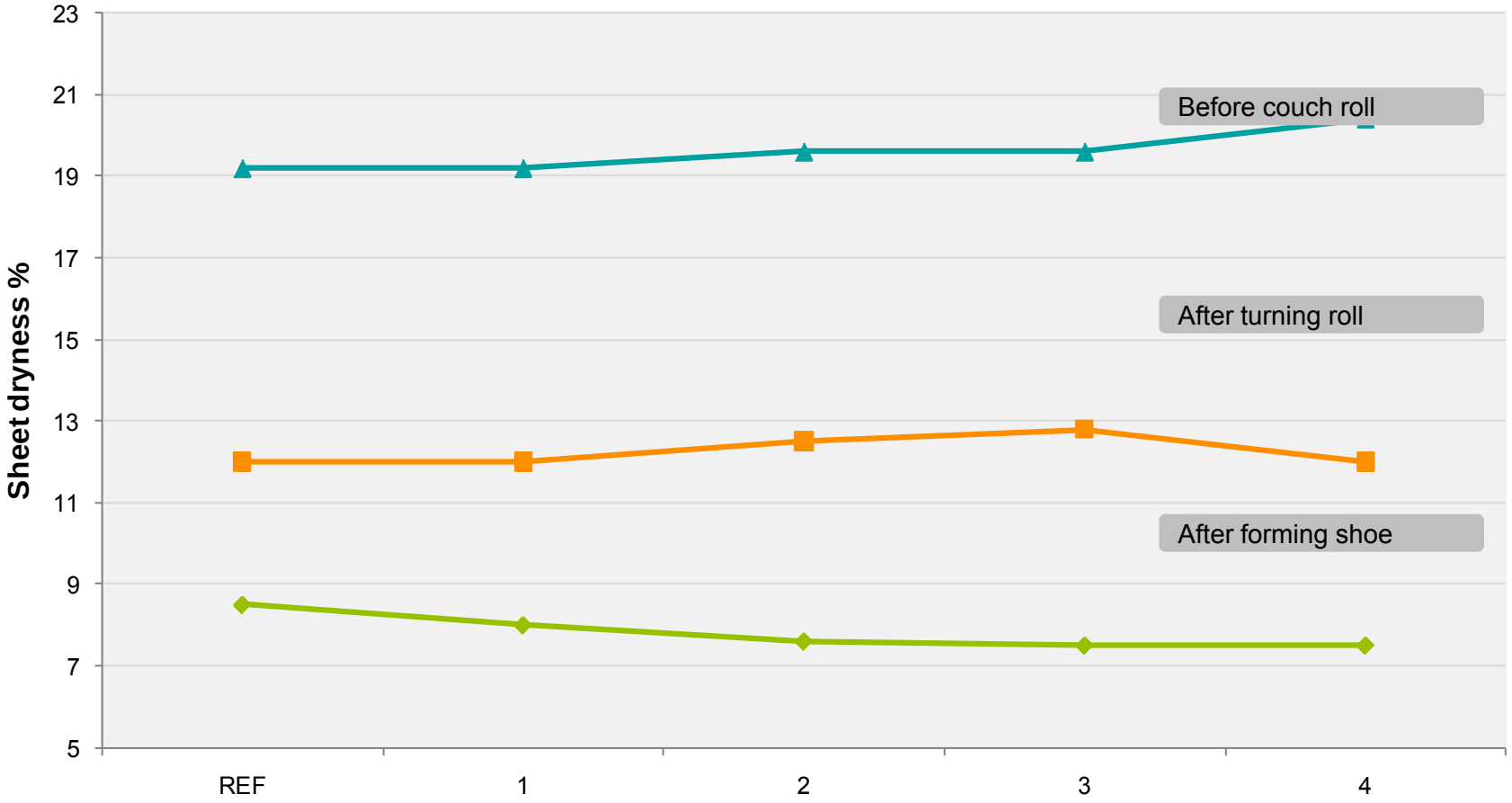
Suction box vacuums in test

Gap forming concept, 100 g/m2 linerboard, 100 % recycled fiber-based furnish, production data

Test point number	Multi foil shoe [kPa]	Forming shoe 1 [kPa]	Forming shoe 2 [kPa]	Forming shoe 3 [kPa]	Curved box 1 [kPa]	Curved box 2 [kPa]	Suction box [kPa]	Transfer box [kPa]	Suction box 1/1 [kPa]	Suction box 1/2 [kPa]	Suction box 2/1 [kPa]	Suction box 2/2 [kPa]
Ref	-10	-12	-14	-18	-20	-22	-23	-22	-27	-32	-41-	-43
1	-5	”	”	”	”	”	”	”	”	”	”	”
2	”	-10	-15	-15	”	”	”	”	”	”	”	”
3	”	-5	-10	-15	”	”	”	”	”	”	”	”
4	”	”	”	”	-10	-15	”	”	”	”	”	”
5	”	”	”	”	”	”	”	”	-20	-25	”	”
6	”	”	”	”	”	”	”	”	”	”	-35	-40

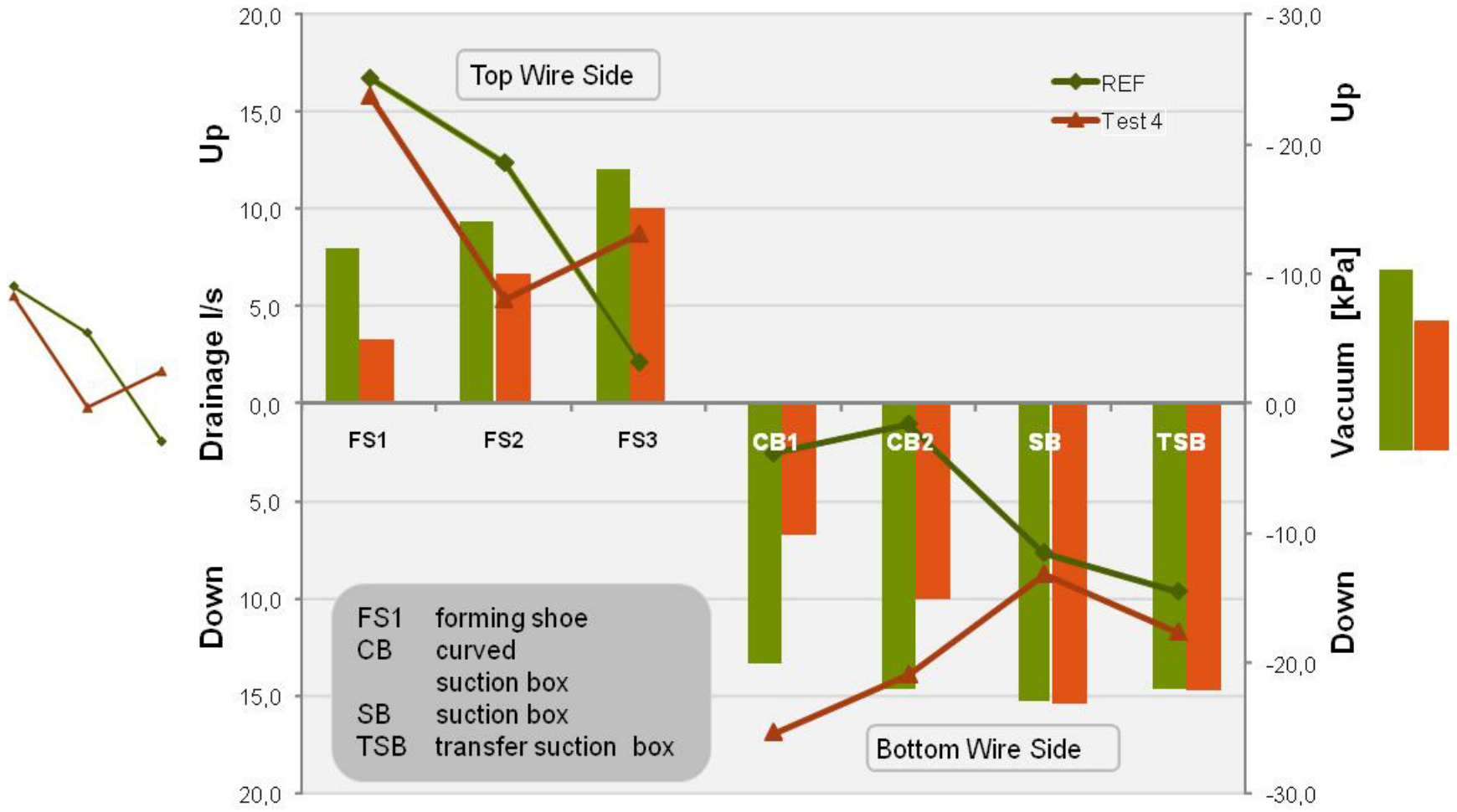
Dryness level development of a gap former

Containerboard machine, production data



Suction box drainage in a twin wire zone

Containerboard machine, production data



Development of drive power and dryness before the couch roll

Containerboard machine, producttion data