

# Tecnologías sostenibles para generaciones futuras

AFPC | mayo/2023



**Voith es una empresa de tecnología con operaciones globales**

**VOITH**

**Empresa familiar  
orientado a valores**



**Maquinas  
y sistemas**

**Responsabilidad con  
la sociedad y el medio  
ambiente**



**Aplicaciones y  
soluciones digitales**

# Impulsamos el potencial del papel

# VOITH

# 100%

La fabricación de papel inteligente garantiza procesos eficientes y un consumo mínimo de recursos para una economía circular

Una cada tres hojas de papel es producido por una máquina Voith

# 3x



# Voith en números

**VOITH**

Datos de: 2020/21



60

Países

19.918

5

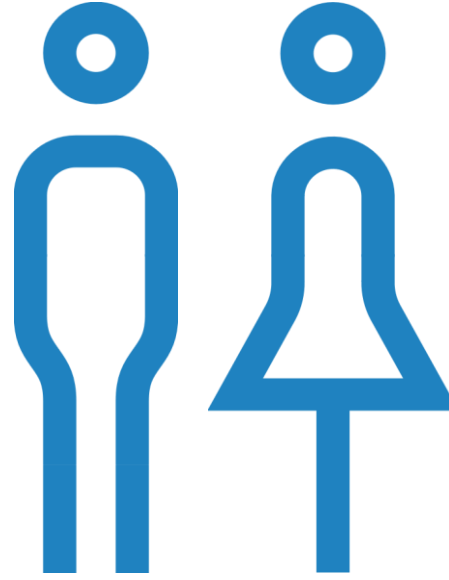
Mercados



90

Nacionalidades

Colaboradores



4,5

%

Inversiones  
en P&D

Empresa familiar  
desde

1867



4,3  
bn

Ventas

¿Qué nos motiva?

La búsqueda de respuestas a los grandes desafíos de nuestro tiempo

**VOITH**



**Potencial**

¿Cómo aumentamos el alcance de nuestra innovación?



**Sostenibilidad**

¿Cómo aceleramos la transformación de la industria?



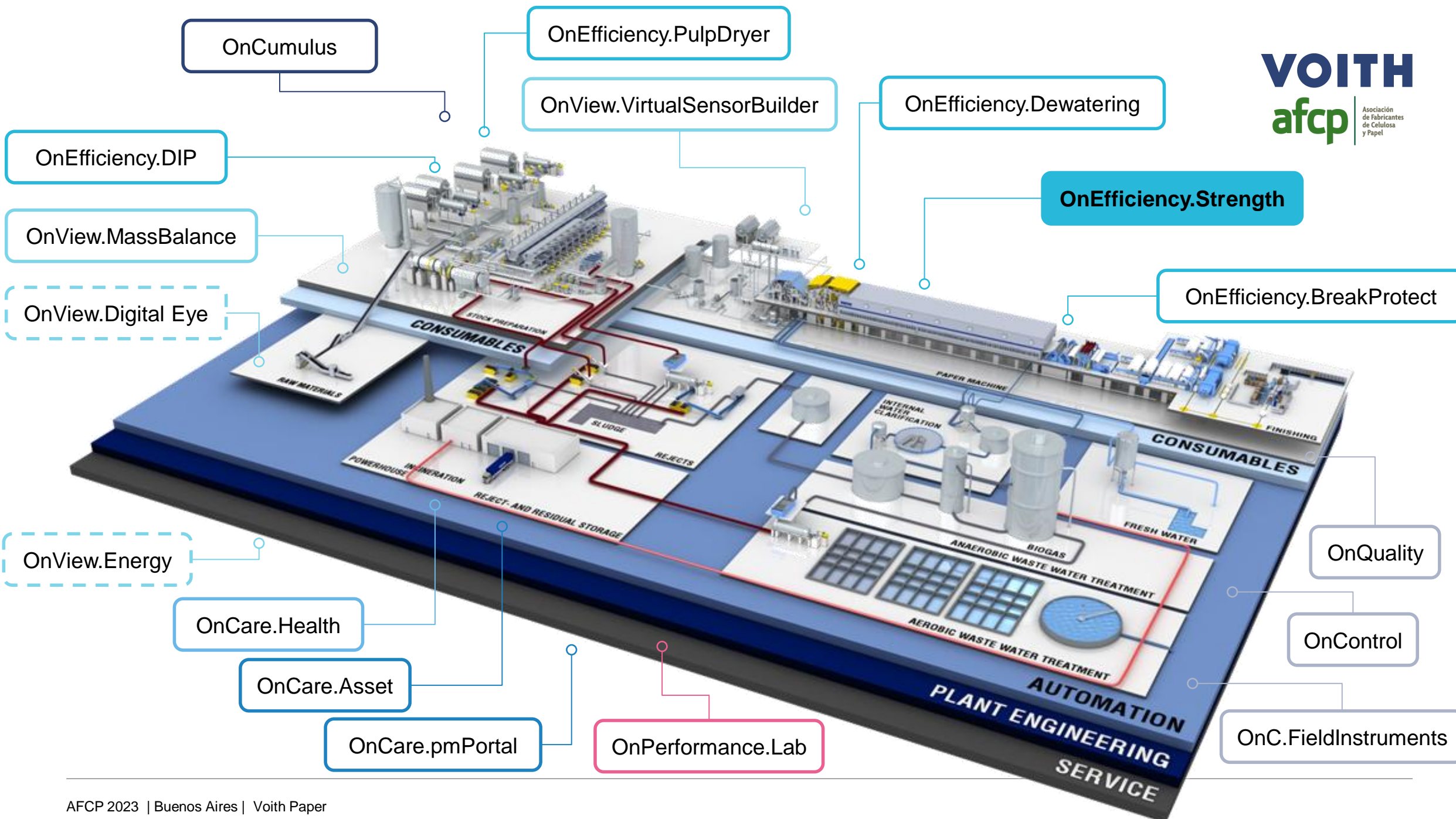
**El futuro**

¿Cómo podemos definir el futuro de nuestras economías?

# La producción de papel en tiempos de Transformación Digital

Ivan Medeiros | AFCP | 2023-02-08





OnCumulus

OnEfficiency.PulpDryer

OnView.VirtualSensorBuilder

OnEfficiency.Dewatering

OnEfficiency.Strength

OnEfficiency.BreakProtect

OnEfficiency.DIP

OnView.MassBalance

OnView.Digital Eye

OnView.Energy

OnCare.Health

OnCare.Asset

OnCare.pmPortal

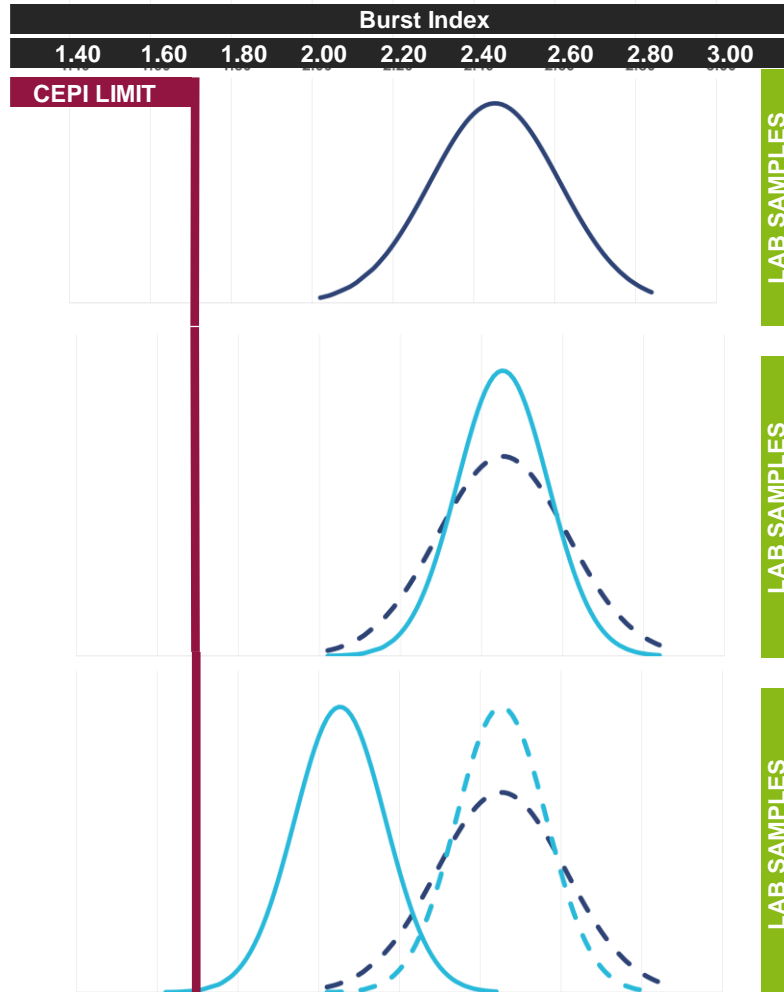
OnPerformance.Lab

OnQuality

OnControl

OnC.FieldInstruments

# Concepto Distribución de calidad



La distribución normal de las propiedades de calidad debe estar por encima del límite de especificación para evitar reclamos o rebajas.

Mediante la introducción del control de procesos, teóricamente puede ser posible reducir las variaciones.

Con variaciones más estrechas, se puede definir un nuevo punto de ajuste, y entonces se lograrían ahorros considerables.



# Concepto Principales desafíos

¡La fabricación de papel no es una tarea fácil!



## Rebajas o reclamos

Por lo general, el papel ya se produce muy cerca de los límites de calidad.



## Costo de producción

Siempre hay un compromiso difícil para alcanzar la especificación con el menor costo posible



## Capacidad de funcionamiento de la máquina

Dependiendo de lo que se haga, se puede desencadenar una pesadilla afectando gravemente la productividad



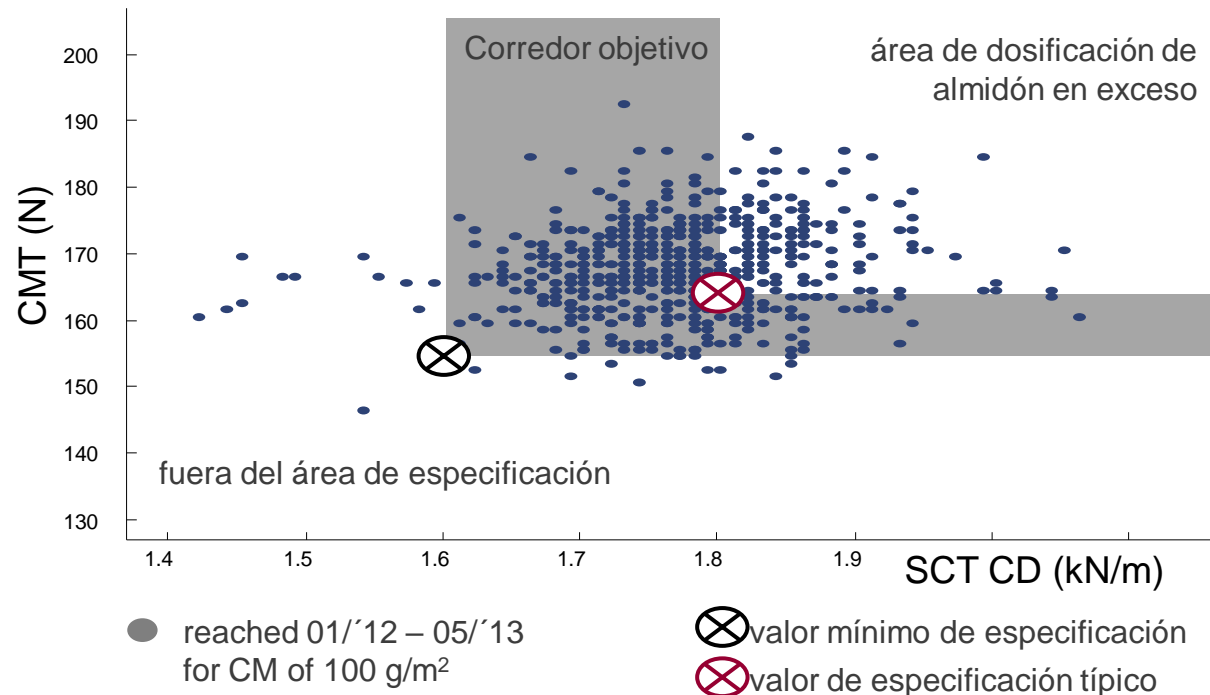
## Resistencia es una prueba destruktiva

Se han hecho varios intentos hasta ahora para predecir, casi ninguno realmente exitoso

# Ejemplo Real

## Falta de transparencia x miedo a la descalificación

### Testliner – Estudio operativo (Alemania, 380,000 tpa)

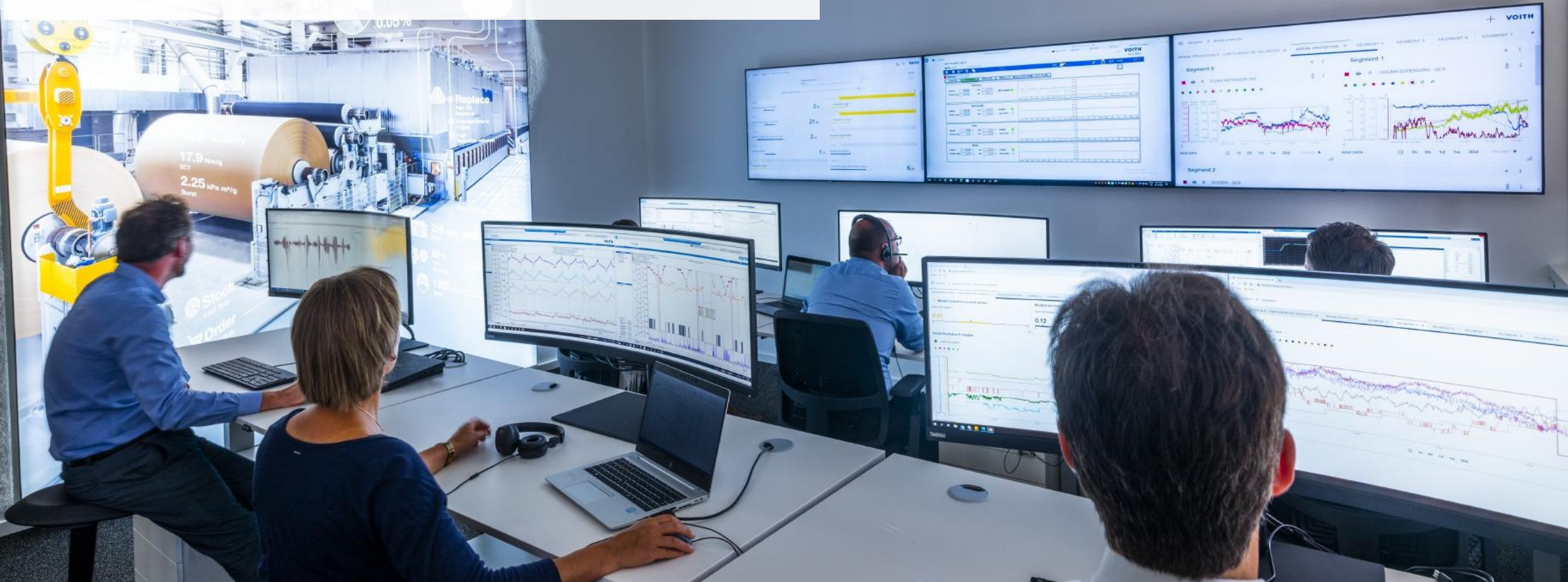


### Comportamiento operativo

Las variaciones en las pruebas físicas de la hoja se compensan con una dosis excesiva de almidón.

➔ “El costo del miedo” (2€/ton)

# ¿Cómo puede ayudarme la digitalización? para superar estos desafíos?



# Sensor Virtual

## Medición en tiempo real sin usar sensor físico

Datos de proceso



Datos de la máquina



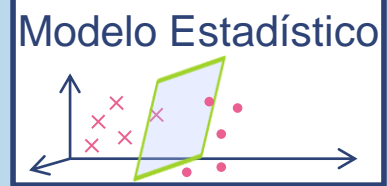
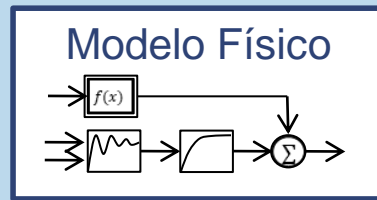
Datos del QCS



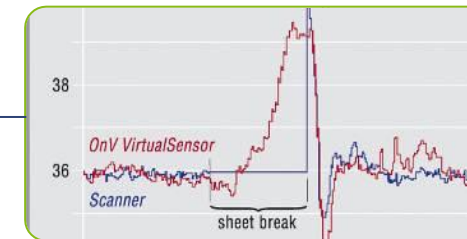
Datos del Laboratorio



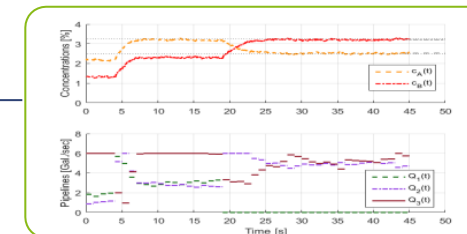
Sensor Virtual



Visualización



Control Avanzado – lazo cerrado

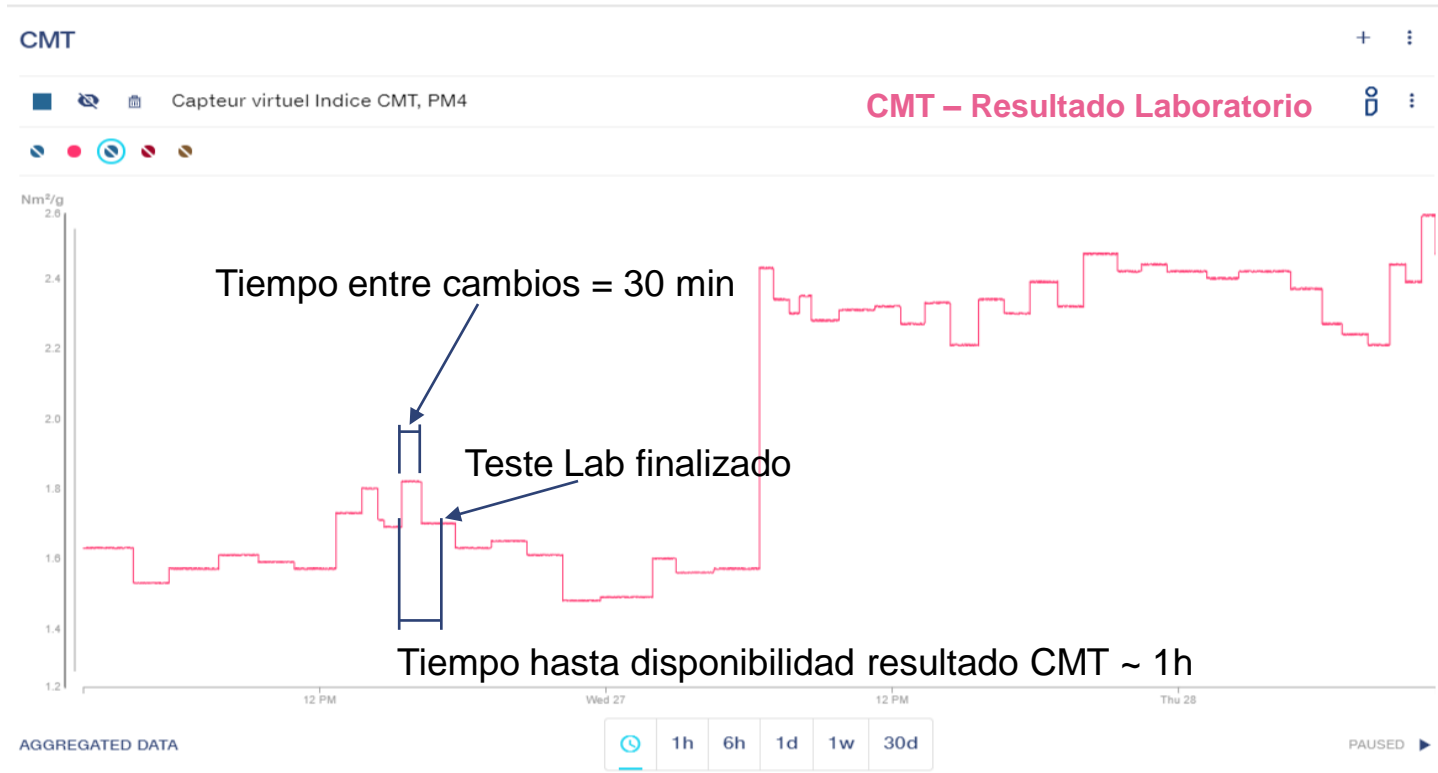


# Hoy, los valores de resistencia se miden en el laboratorio

## Valores disponibles solo después de cada bobina

### Situación actual

- Un valor CMT al final de cada bobina
- Tiempo producción de bobina de 30 min a 1h.
- Tiempo típico de análisis laboratorio de 30 min a 1h.
- Variaciones de CMT pueden ocurrir en menos de 1h.
- No se puede controlar las variaciones del proceso



# Tres pasos para crear un sensor virtual



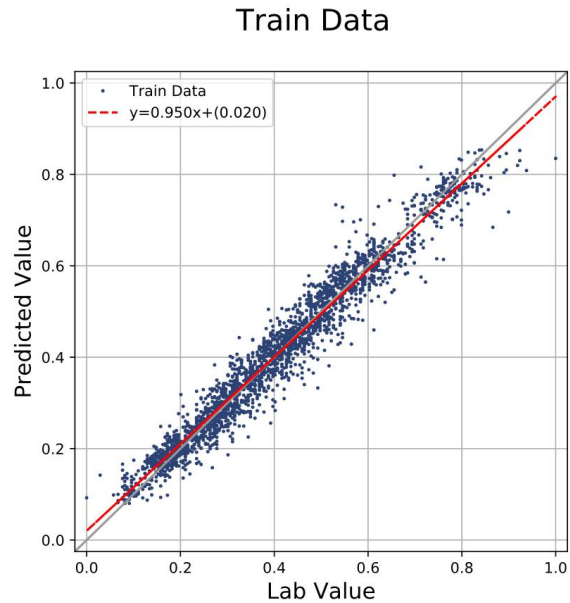
(1) Modelado offline

(2) Implementación y mejora

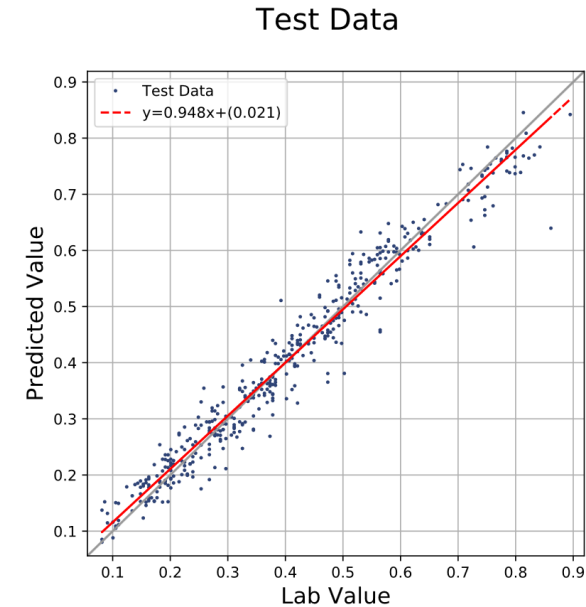
(3) Validación

# (1) Modelado offline

## Ejemplo de correlación



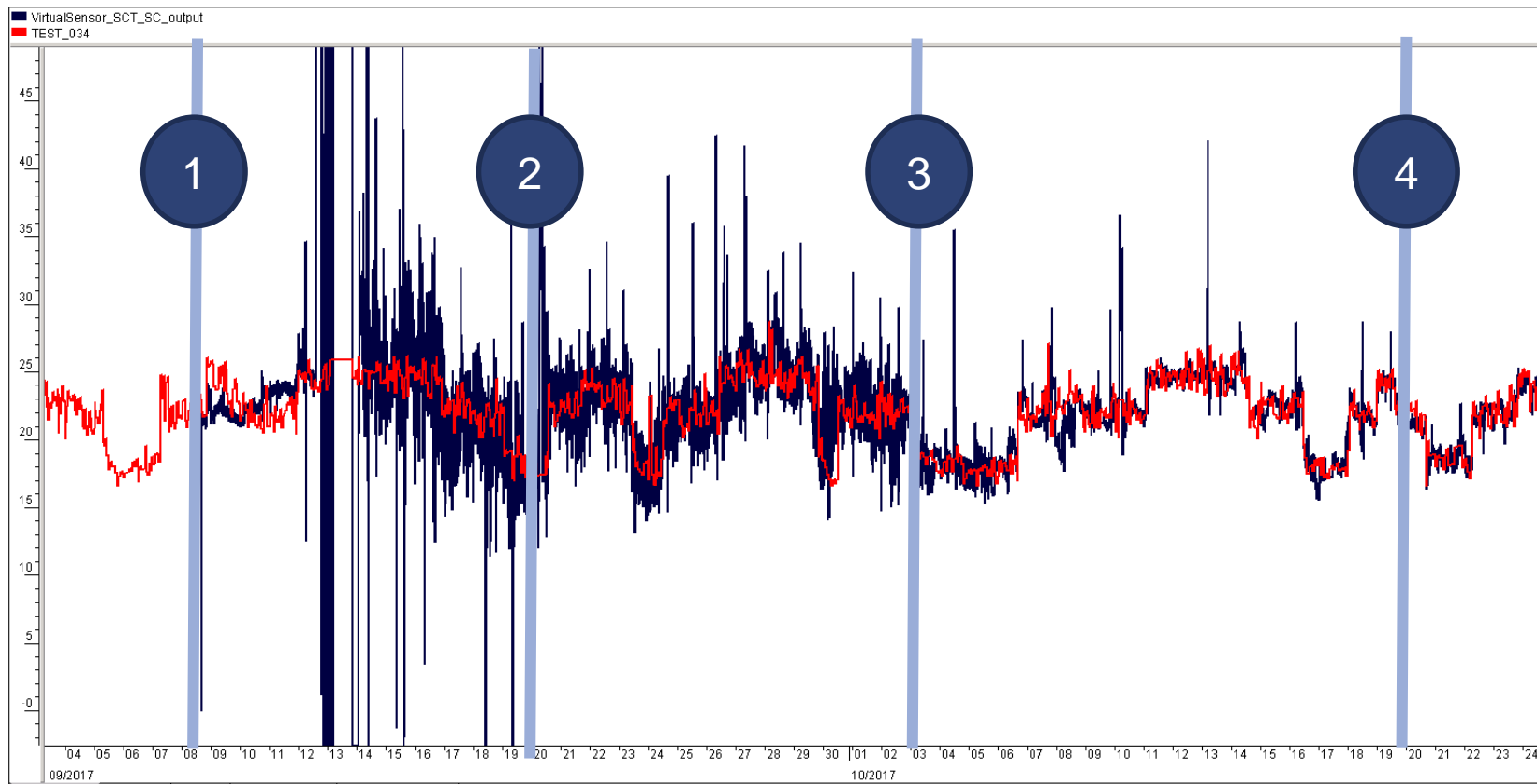
| Métrica                | Valor         |
|------------------------|---------------|
| Dimensión de los datos | 85 %          |
| Resultados             | 0.9577        |
| RMSE                   | Não calculado |
| <b>Correlación</b>     | <b>97 %</b>   |



| Métrica                | Valor       |
|------------------------|-------------|
| Dimensión de los datos | 15 %        |
| Resultados             | 0.9495      |
| RMSE                   | 0.0851      |
| <b>Correlación</b>     | <b>97 %</b> |

# (2) Implementación y mejora

## Mejora de la calibración del Sensor Virtual por pasos



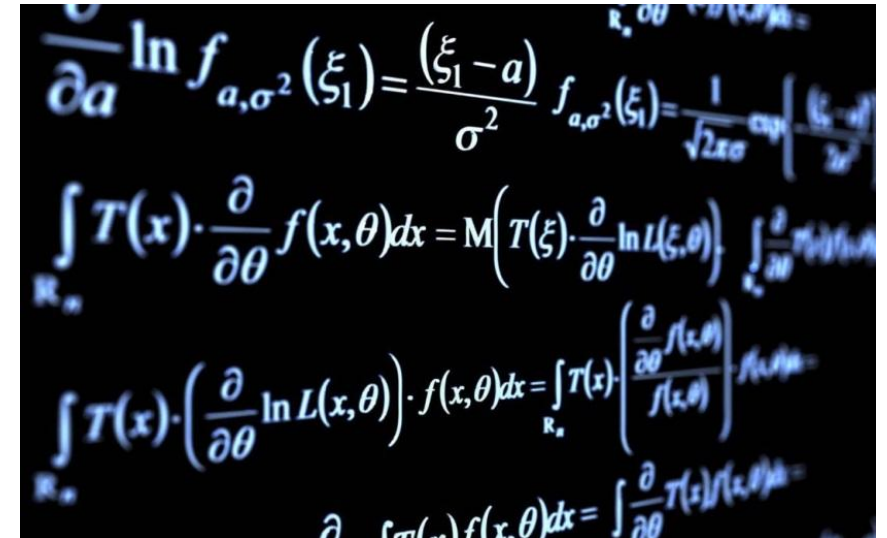
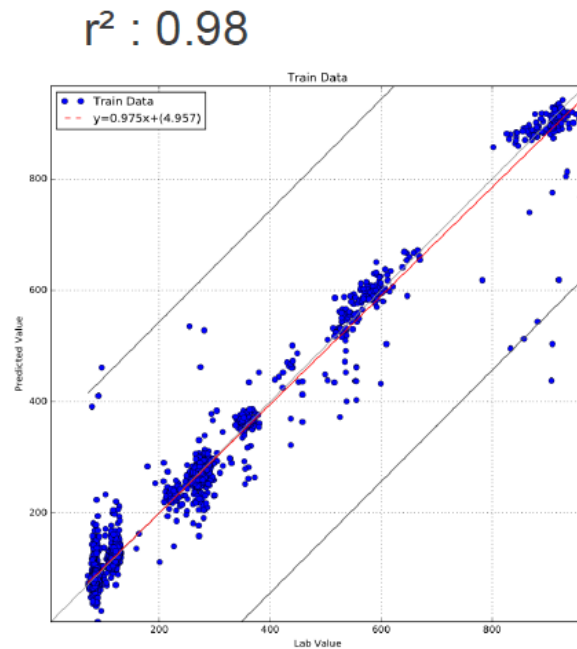
### Implementación em pasos

1. Empezar bajo supervisión
2. Calibración automática + ajuste manual
3. Compensación de la diferencia horaria
4. Eliminación de anomalías (por ejemplo, roturas, tiempos de inactividad)

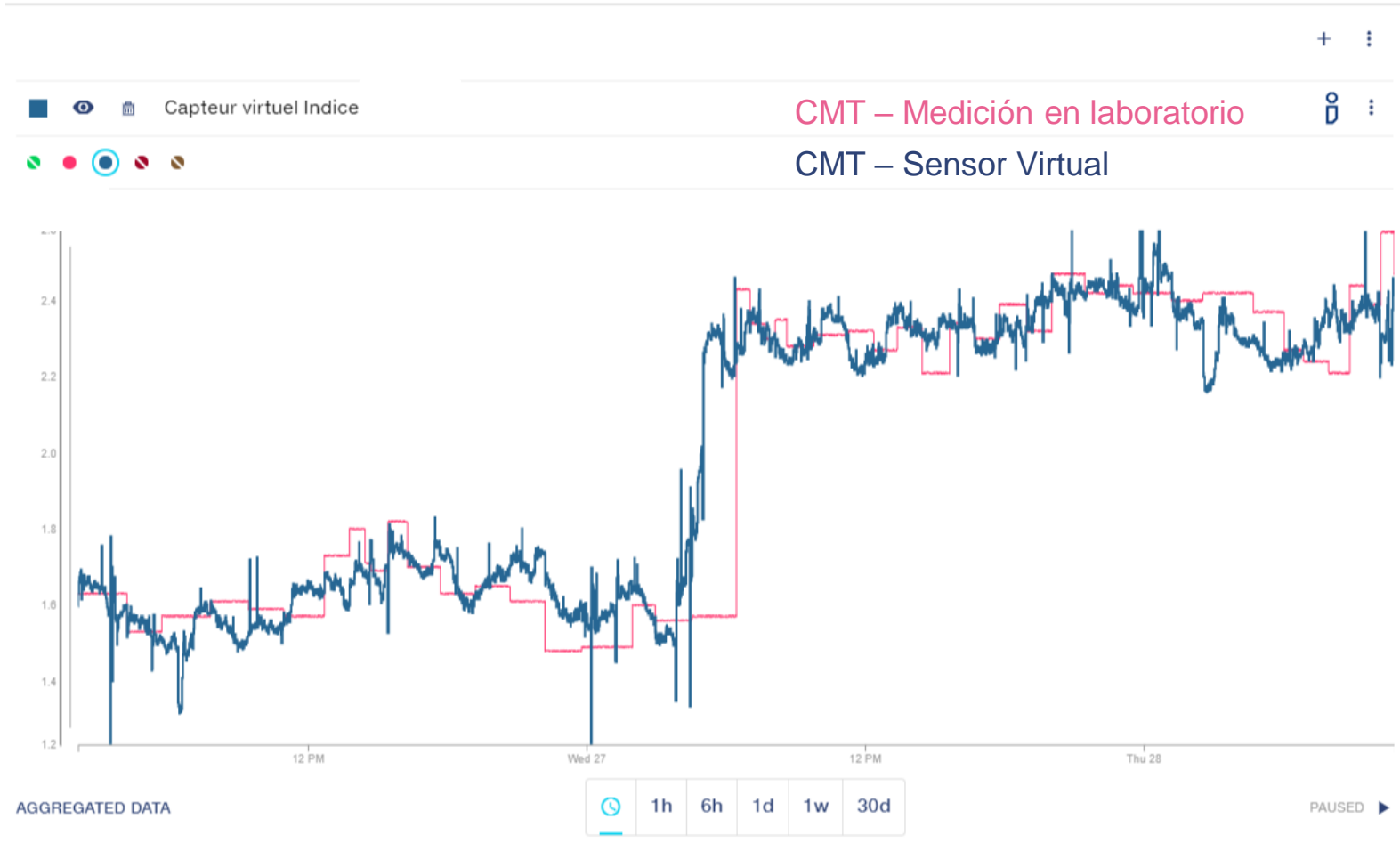
→ **Sensor Virtual listo para operación**



# (3) Validación Correlación con laboratorio



# Con sensores virtuales Los valores de resistencia se conocen continuamente

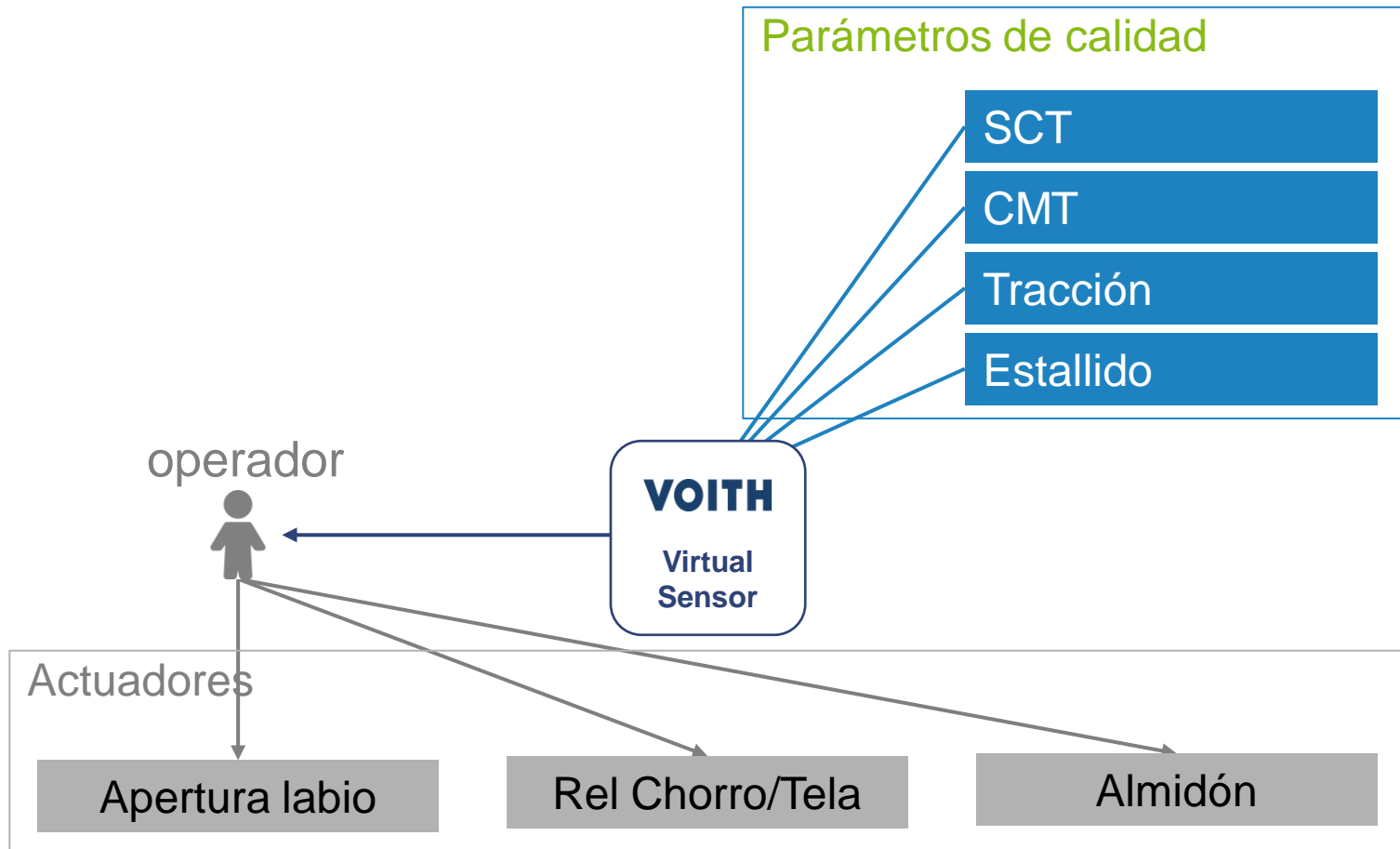


## Situación con el sensor virtual

- Tracción en tiempo real
- No hay retraso en los resultados (análisis de laboratorio)
- Conocimiento inmediato de las variaciones del proceso
- Cambios de producción dentro de las especificaciones de calidad

# Sensor Virtual

## Visualización de parámetros en línea

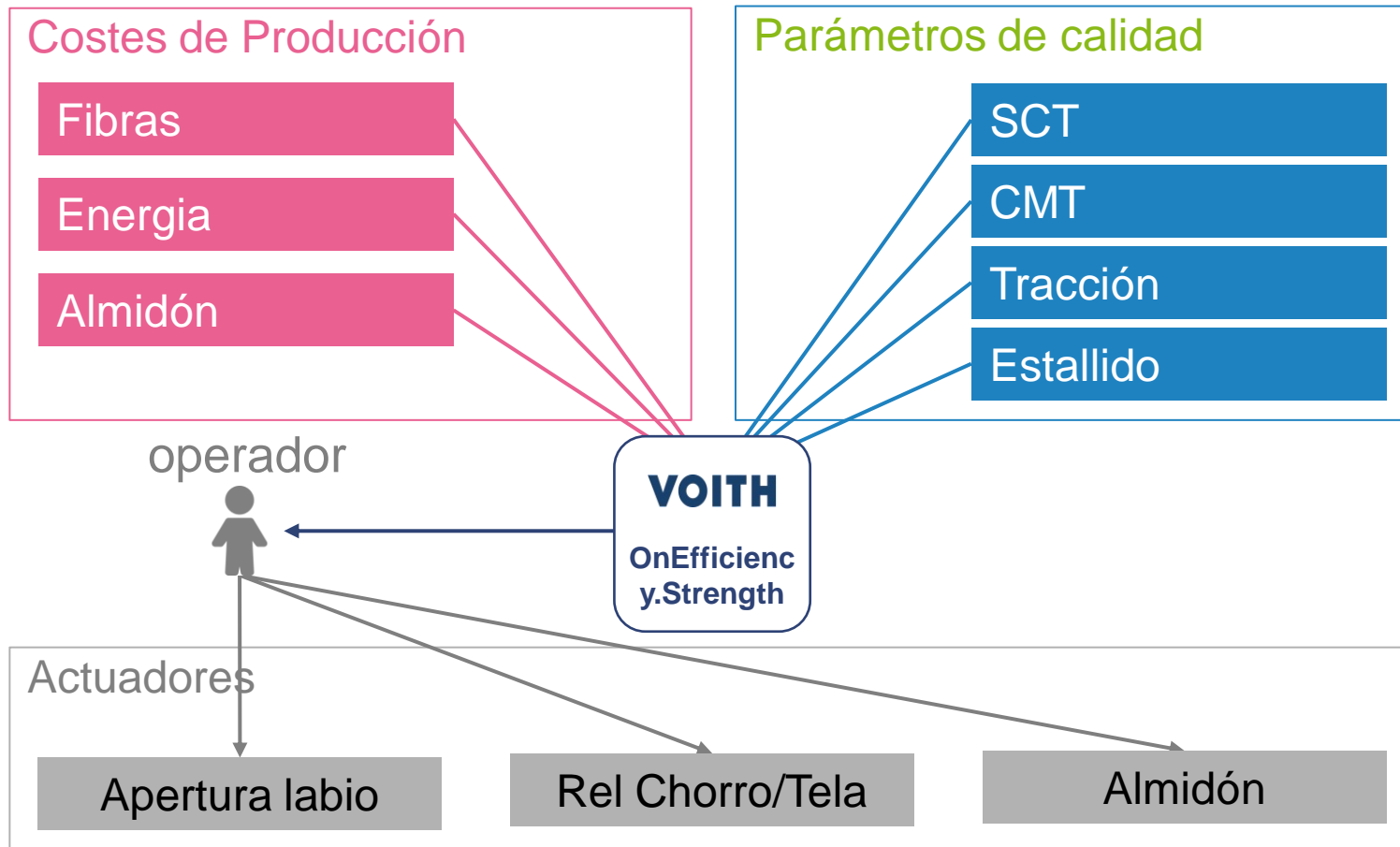


### Sensor virtual

- A medición de los Sensores Virtuales desplegada al operador
- Operador decide de acuerdo con su experiencia
- Cada turno maneja su propia estrategia
- O impacto financiero desconsiderado

# OnEfficiency.Strength en lazo abierto

## Modelo de Control sugiere acciones al operador

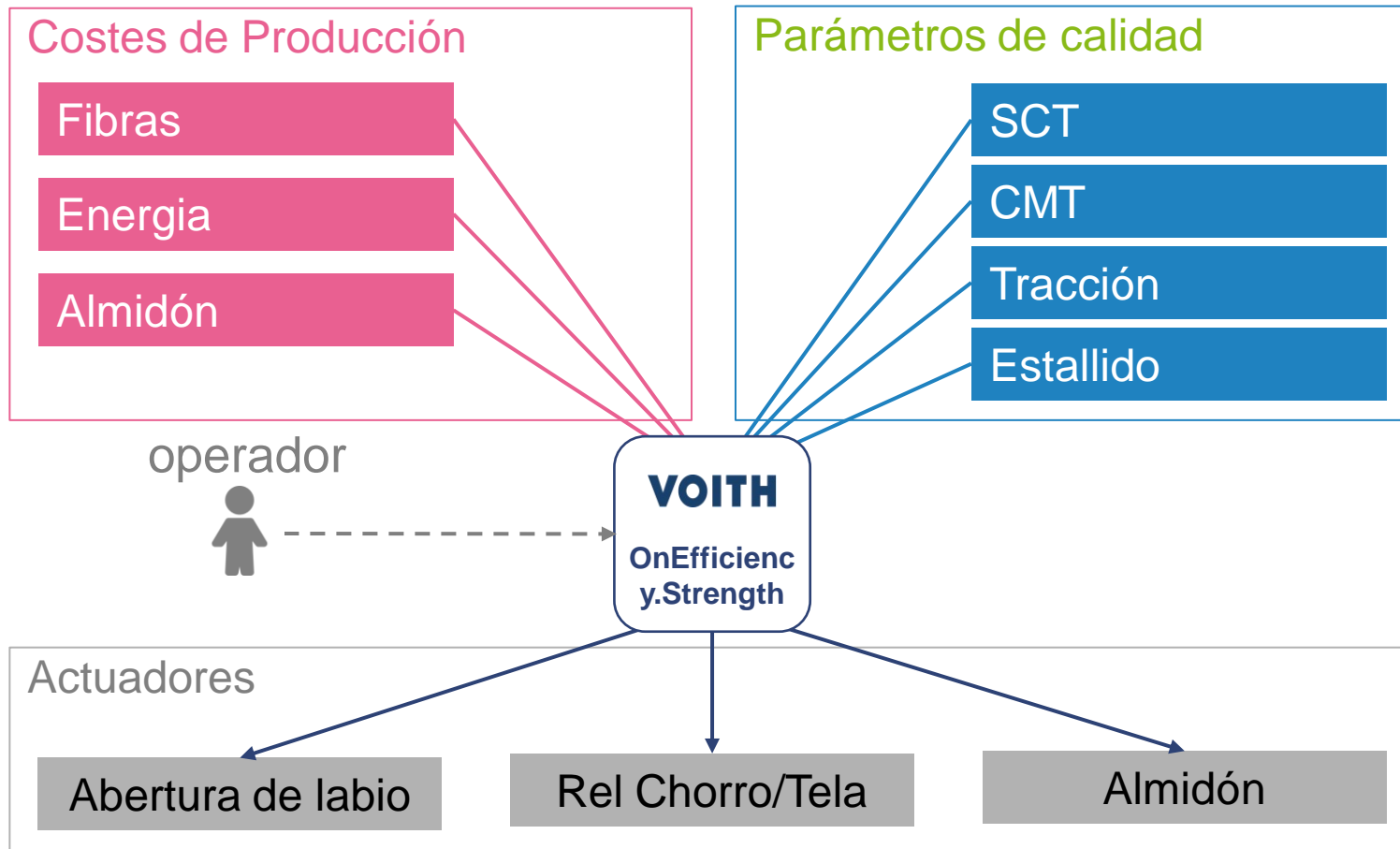


### Control en lazo abierto

- OnEfficiency.Strength sugiere entradas para alcanzar la calidad objetiva al menor coste
- Operador toma decisión respecto sugerencia del control – la experiencia de los operadores prevalece respecto la decisión

# OnEfficiency.Strength en lazo de control cerrado

## Garantiza la calidad adecuada, al menor costo



### Control en lazo cerrado

- OnEfficiency.Strength mantiene SCT, CMT, tensión y estallido (dependiendo del producto) dentro de la especificación
- OnEfficiency.Strength reduce los costes de producción minimizando el uso de almidón y el gramaje
- El operador supervisa el funcionamiento correcto, y si fuera necesario, realiza los ajustes pertinentes

# Referencias

## OnEfficiency.Strength

| Start-up | Company         | Site & PM         | Country  | Grade                        | Virtual Sensor                             |
|----------|-----------------|-------------------|----------|------------------------------|--|
| 2022     | Papresa         | Erretería PM5     | Spain    | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
|          | Modern Karton   | Modern Karton PM6 | Turkey   | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
|          | SCA             | Obbola PM2        | Sweden   | Kraftliner                   | tbd  |
|          | Ilim Group      | Ilimsk BM1        | Russia   | Kraftliner / Virgin Fluting  | SCT, CMT, Burst                            |
|          | DS Smith        | Witzenhausen PM1  | Germany  | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
|          | Uipsa           | La Pobla PM1      | Spain    | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
|          | Smurfit Kappa   | Hoya PM2          | Germany  | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
| 2021 03  | SAICA           | El Burgo PM9      | Spain    | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
| 01       | Propapier       | Taurus PM3        | Germany  | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
| 2020 12  | SCA             | Obbola PM1        | Sweden   | Kraftliner / Testliner       | SCT, Burst                                 |
| 11       | BillerudKorsnäs | Gruvön KM7        | Sweden   | CSPB / FBB / LPB             | Bending Stiffness, Ply Bond, Caliper, Curl |
| 10       | Fedrigoni       | Fabriano PM3      | Italy    | Copy paper                   | Caliper, Stiffness                         |
| 09       | Heinzel Papier  | Laakirchen PM10   | Austria  | Testliner / Recycled Fluting | SCT, CMT, Burst                            |
| 2019 10  | Metsä Board     | Kyro PM1          | Finland  | FBB                          | Bending Stiffness, Ply Bond                |
| 2018 12  | Mondi           | Ruzomberok PM18   | Slovakia | Copy paper                   | Bending Stiffness                          |
| 07       | SAICA           | Venizel PM4       | France   | Testliner / Recycled Fluting | SCT CD, SCT MD, Burst, CMT                 |
| 2017     | N.N.            | N.N.              | China    | Linerboard                   | Burst, Ply Bond                            |
| 2016     | N.N.            | N.N.              | USA      | Linerboard                   | SCT, CMT, Burst                            |

# OnEfficiency.Strength

## Savings examples

|                                | Testliner  | Copy  | Kraftliner                     |
|--------------------------------|--|---|--------------------------------|
| Production / year              | 350,000 t/a                                      | 350,000 t/a   | 420,000 t/a                    |
| Fiber cost                     | 100 €/t  | 300 €/t   | 500 €/t                        |
| Starch cost                    | 350 €/t  |   |                                |
| Filler cost                    |  | 150 €/t   |                                |
| Average basis weight           | 100 g/m <sup>2</sup>                             | 80 g/m <sup>2</sup>   | 180 g/m <sup>2</sup>           |
| Savings are achieved by        | Reduction of starch while optimizing fiber usage | Reduction of fiber usage & replacement by filler                | Reduction of fiber usage       |
| Optimization                   | ↓ 0.5 g/m <sup>2</sup> starch                    | ↓ 0.5 g/m <sup>2</sup> fibers<br>↑ 0.24 g/m <sup>2</sup> filler | ↓ 3.5 g/m <sup>2</sup> fibers  |
| Total starch / fiber reduction | 1,750 t/a (-10% starch)                          | 3,240 t/a (-0.9% fiber)   | 8,150 t/a (-1.9% fiber)        |
| <b>Total savings</b>           | <b>440,000 €/a (1.3 €/t)</b>                     | <b>814.000 €/a (2.3 €/t)</b>                                    | <b>4,000,000 €/a (9.5 €/t)</b> |

# OnEfficiency.Strength

## Mondi Ruzomberok PM18



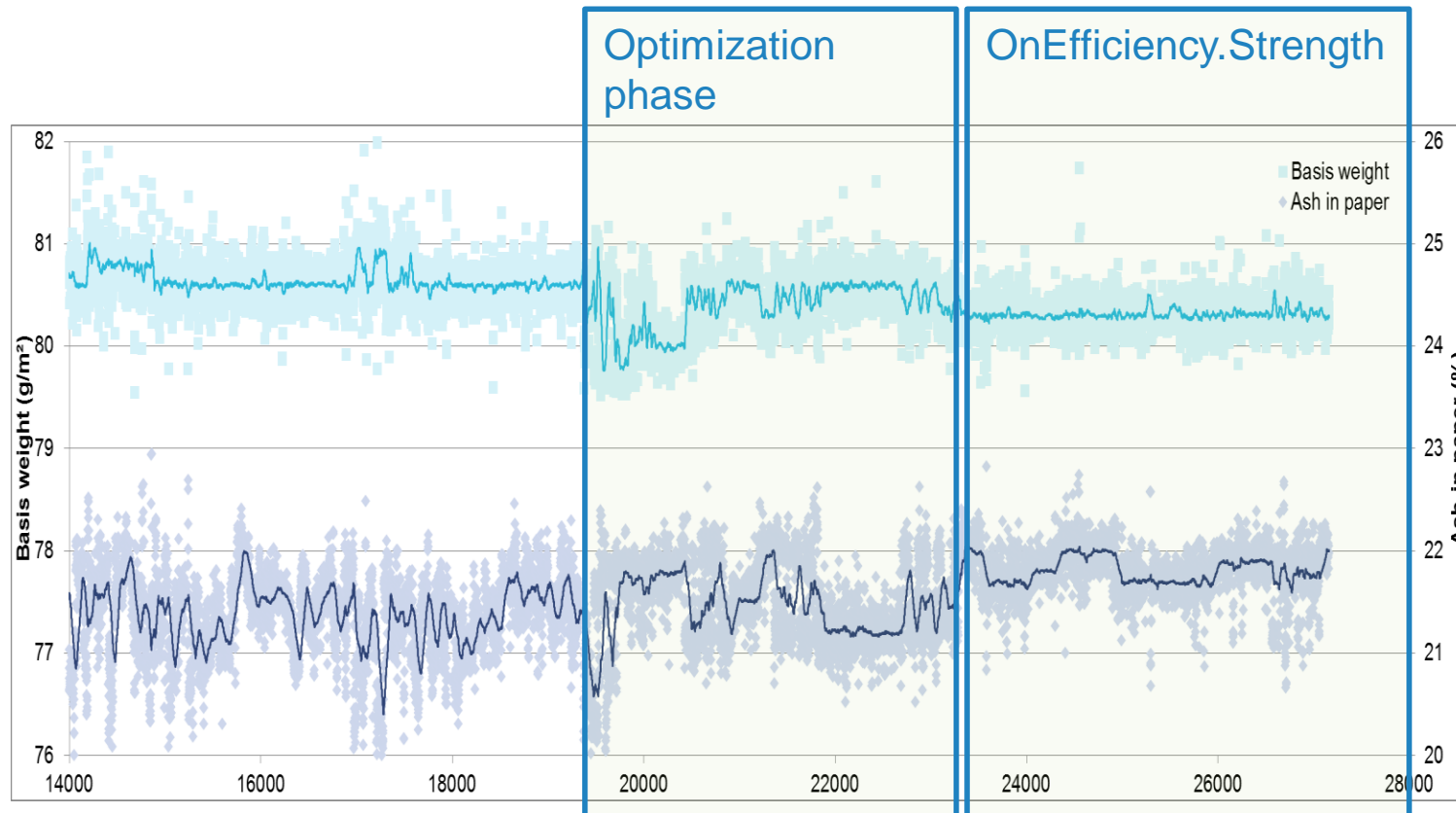
|                             |   |
|-----------------------------|---|
| <b>Customer</b>             | Mondi Ruzomberok PM18   |
| <b>Grades</b>               | Copy Paper  |
| <b>Capacity</b>             | 375 ktpy (75 – 83 gsm, 1600 m/min)  |
| <b>Start-up</b>             | December 2018   |
| <b>Virtual sensors</b>      | Bending stiffness, caliper  |
| <b>Actuators</b>            | Basis weight, ash   |
| <b>OnEfficiency concept</b> | Substitute fibers by ash and stabilize and slightly reduce basis weight while maintaining bending stiffness and caliper |
| <b>Confirmed savings</b>    | 2,800 tons of fibers in the first year were officially confirmed by the customer as part of the success story           |



# OnEfficiency.Strength

## Resultados Ruzomberok PM18

### OnEfficiency.Strength results, Ruzomberok PM18



### Results

2,800 tpy fiber savings in the first year, by

- ~ 0.5% basis weight reduction
- ~ 0.3%-points ash increase

Entire process was stabilized, keeping the quality (stiffness) above the specified level.

*“After we installed OnEfficiency.Strength, the basis weight and the ratio of fiber to ash improved substantially. As a result of this advanced process control system, we could stabilize our paper manufacturing process and are now able to proactively control paper quality. This means that we can achieve the required paper quality even with a higher ash content and lower basis weight, as confirmed by our laboratory measurements.”*

Peter Chlepko, PM 1, 16, 17, 18 Manager - Mondi SCP, a.s.  
Uncoated Fine Paper

# OnEfficiency.Strength Fedrigoni Fabriano PM3

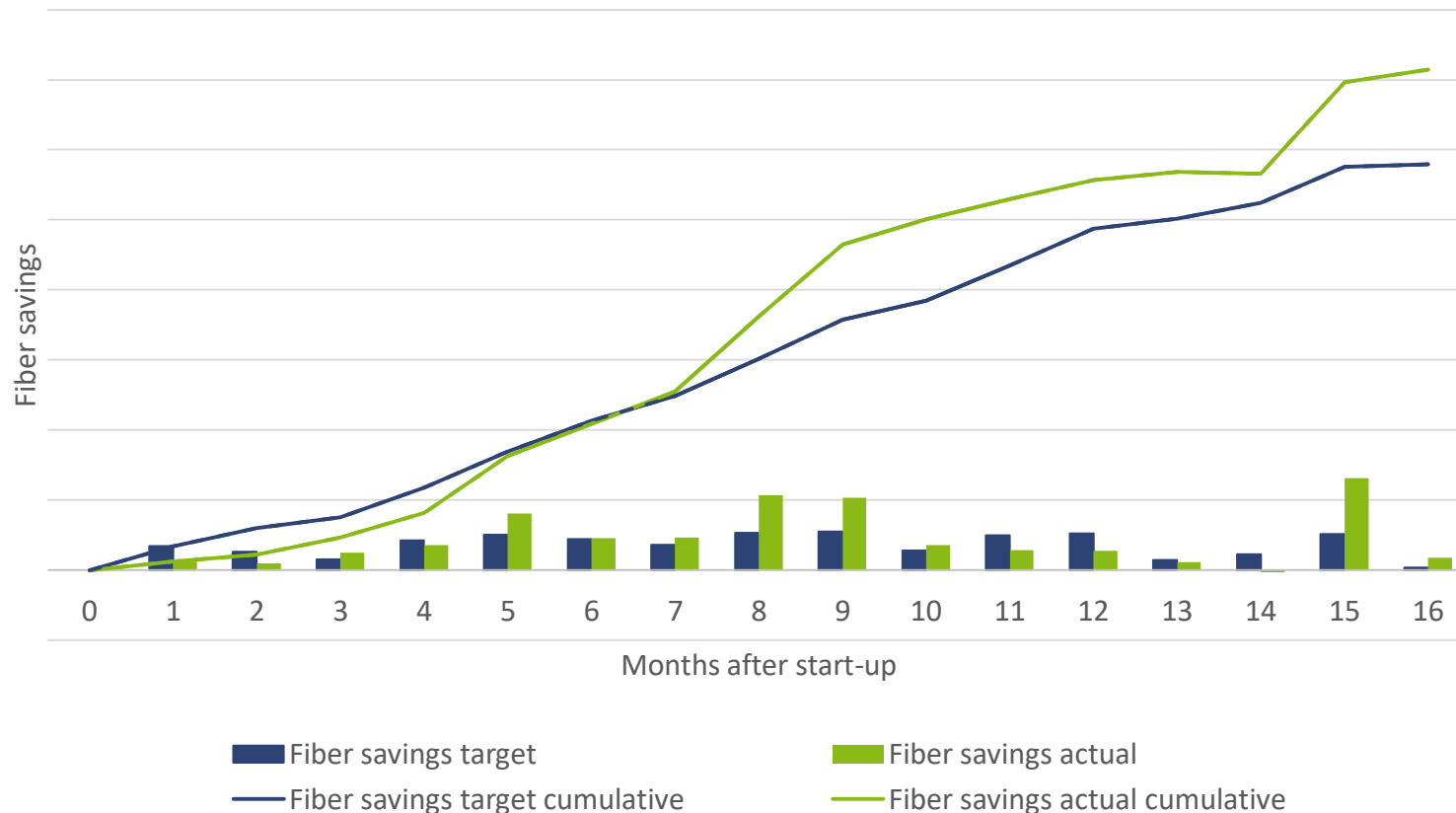


|                             |  |
|-----------------------------|--|
| <b>Customer</b>             | Fedrigoni S.p.A., Italy  |
| <b>PM</b>                   | Fabriano PM3   |
| <b>Grades</b>               | Copy paper   |
| <b>Capacity</b>             | 140.000 tpy  |
| <b>Start-up</b>             | September 2020   |
| <b>Virtual sensors</b>      | Caliper (stiffness in second step)   |
| <b>Actuators</b>            | basis weight, filler   |
| <b>OnEfficiency concept</b> | Reduce fiber consumption by keeping caliper in lower range of specs, reducing BW and increasing filler content |
| <b>Confirmed savings</b>    | Confidential<br>Above guaranteed values  |

# OnEfficiency.Strength

## Resultados Fabriano PM3 (140 ktpy Copy)

### OnEfficiency.Strength results, Fabriano PM3



How did the **integration** into the existing systems work? “**Extremely easy**”

*Libero Grandoni, Production Manager, June 2021*

The best moment?

“Every day, when in the morning I check the produced paper and I realize that, **with OnEfficiency activated, I can reach the results** in terms of optimization of the product specifications, that **I wouldn't have reached without OnEfficiency**”

*Libero Grandoni, Production Manager, June 2021*

“(...) The **OnEfficiency** project developed in Fabriano with Voith represents a basic milestone of our digital transformation. Beyond the **significant economic benefit (payback < 1 year)**, it allowed us to create a “digital muscle” (...)”

*Mario Naldini, COO Fedrigoni Group, March 2021*

# OnEfficiency.Strength

## Heinzel Papier Laakirchen PM10 (Austria)

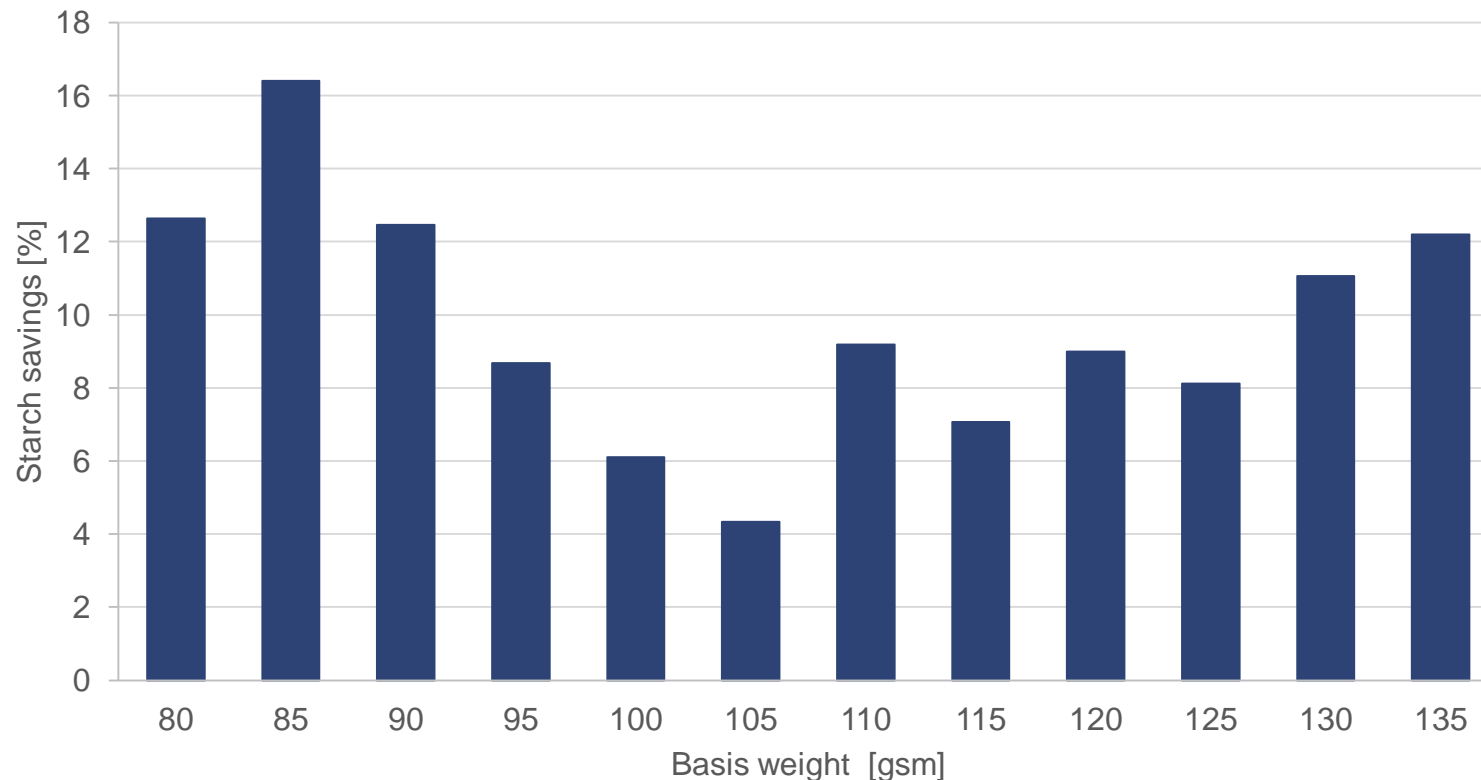


|                             |  |
|-----------------------------|--|
| <b>Customer</b>             | Laakirchen Papier AG, Austria  |
| <b>PM</b>                   | Laakirchen PM10  |
| <b>Grades</b>               | Testliner, Corrugating Medium  |
| <b>Capacity</b>             | 450.000 tpy  |
| <b>Start-up</b>             | October 2020   |
| <b>Virtual sensors</b>      | SCT, CMT, burst  |
| <b>Actuators</b>            | jet/wire ratio, starch consistency and rod pressure  |
| <b>OnEfficiency concept</b> | Minimize starch application and broke by optimally using fiber strength potential and controlling starch application |
| <b>Confirmed savings</b>    | average 4% starch savings in 2021<br>average 10% in 2022 (Jan – March)   |

# OnEfficiency.Strength

## Resultados Laakirchen PM10 (450 ktpy TL/CM)

OnEfficiency.Strength results, Laakirchen PM10, December 2021 – February 2022



“We were looking for a way to **make our production more raw material and cost efficient**, without neglecting our quality.”

“Voith was able to provide us a system with target – **Voith was the only one who could give us a range where we could land.**”

“We are able to **achieve very high savings**, all together we are up to 10%, we are quite happy with the situation here.”

“**We definitely would recommend it to our colleagues!**”

“The biggest advantage is that you **see the strength properties live**. The system goes by its own, all the variations are seen by the system and corrected if it’s possible - to get the best out of it.”

*Christopher Dierkes-Leifeld, Technologist PM10, as a panelist in the customer webinar on 2020-03-24*

# OnEfficiency.Strength Smurfit Kappa Hoya PM2 (Germany)

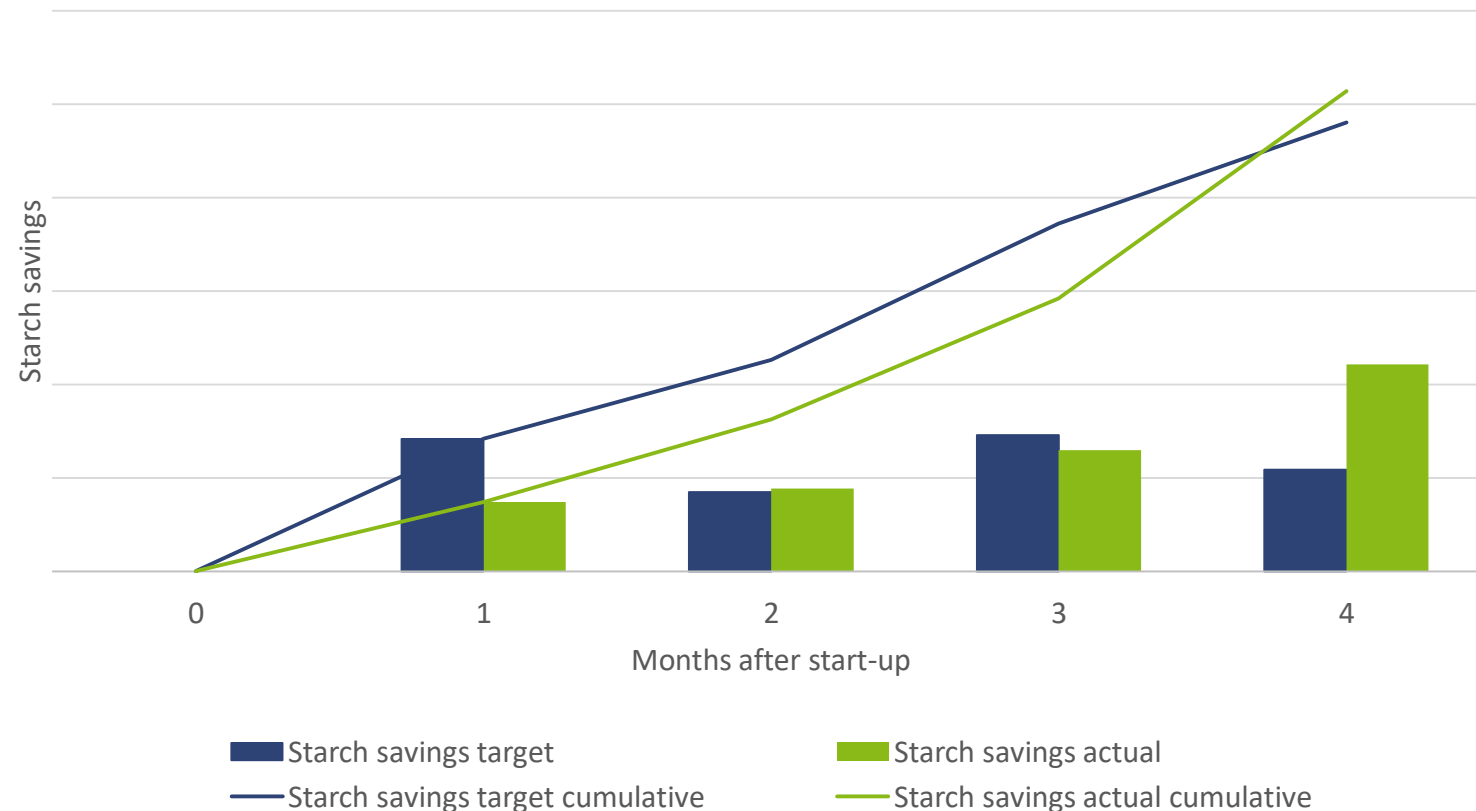


|                             |   |
|-----------------------------|---|
| <b>Customer</b>             | Smurfit Kappa Hoya Papier- & Karton GmbH  |
| <b>PM</b>                   | Hoya PM2  |
| <b>Grades</b>               | Testliner, corrugating medium   |
| <b>Capacity</b>             | 380.000 tpy   |
| <b>Start-up</b>             | November 2021   |
| <b>Virtual Sensors</b>      | SCT CD, S-Test, burst   |
| <b>Actuators</b>            | rod pressure, starch dilution, moisture, basis weight, jet/wire ratio   |
| <b>OnEfficiency concept</b> | Minimize fiber consumption by increasing moisture, reduce starch application and broke by optimally using fiber strength potential and controlling starch application |
| <b>Confirmed savings</b>    | Confidential<br>Above guaranteed values   |

# OnEfficiency.Strength

## Resultados Hoya PM2 (380 ktpy TL/CM)

OnEfficiency.Strength results, Hoya PM2



We chose Voith's digital solution approach because it offers significant cost savings with the latest technologies and pays for itself in less than a year. With the implementation of OnEfficiency.Strength, we are successfully continuing our innovation and digitalization strategy while paying towards our sustainability goals.

*Gerold Buck, Manager Operations at Smurfit Kappa Hoya, January 2022*

# OnEfficiency.Strength

## Saica El Burgo PM9 (Spain)



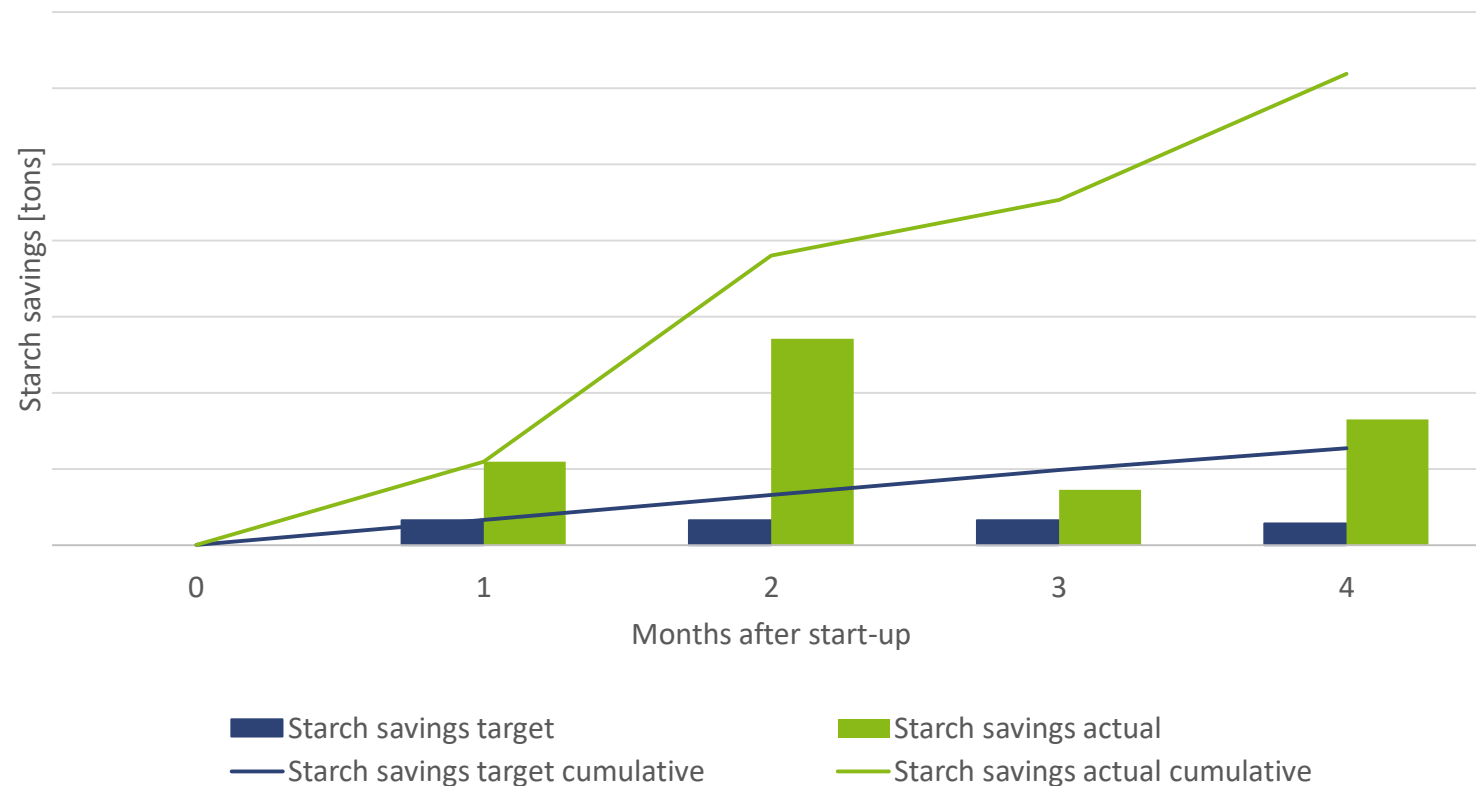
|                             |   |
|-----------------------------|---|
| <b>Customer</b>             | S.A. Industrias Celulosa Aragonesa, Spain   |
| <b>PM</b>                   | El Burgo PM9  |
| <b>Grades</b>               | Testliner / Corrugated Medium (75-115 g/m <sup>2</sup> )  |
| <b>Capacity</b>             | 410.000 tpy   |
| <b>Start-up</b>             | October 2021  |
| <b>Virtual sensors</b>      | SCT, CMT, Burst   |
| <b>Actuators</b>            | Jet/wire ratio, starch concentration, rod pressure  |
| <b>OnEfficiency concept</b> | Minimize starch application by optimally using fiber strength potential (jet/wire ratio) and controlling starch application |
| <b>Confirmed savings</b>    | Confidential<br>Well above guaranteed values  |



# OnEfficiency.Strength

## Resultados Saica El Burgo PM9 (410 ktpy TL/CM)

OnEfficiency.Strength results, El Burgo PM9




"The **integration** of OnEfficiency.Strength into the existing automation technology of PM 9 **was seamless**. This is now reflected in our **very positive results**. The digital tools support us in achieving our ambitious targets in an intelligent way."

*Juan Luis Mendoza, Digital Process Officer, March 2022*

"Although the plant has been continuously optimized in recent years, we have now been able to **significantly reduce our starch usage** in the first few weeks with the help of OnEfficiency.Strength. The tool is **very easy to use**, and the operators are very motivated to integrate it into their daily work. We are confident that, **in the future, savings can be increased even further**. Now it is much easier to sustainably achieve the targeted quality at the lowest possible cost."

*Fernando Vicente, Production Manager PM 9, March 2022*



**Preguntas?  
Dudas?**



# ¡Muchas Gracias!

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**¡Muchas Gracias!**