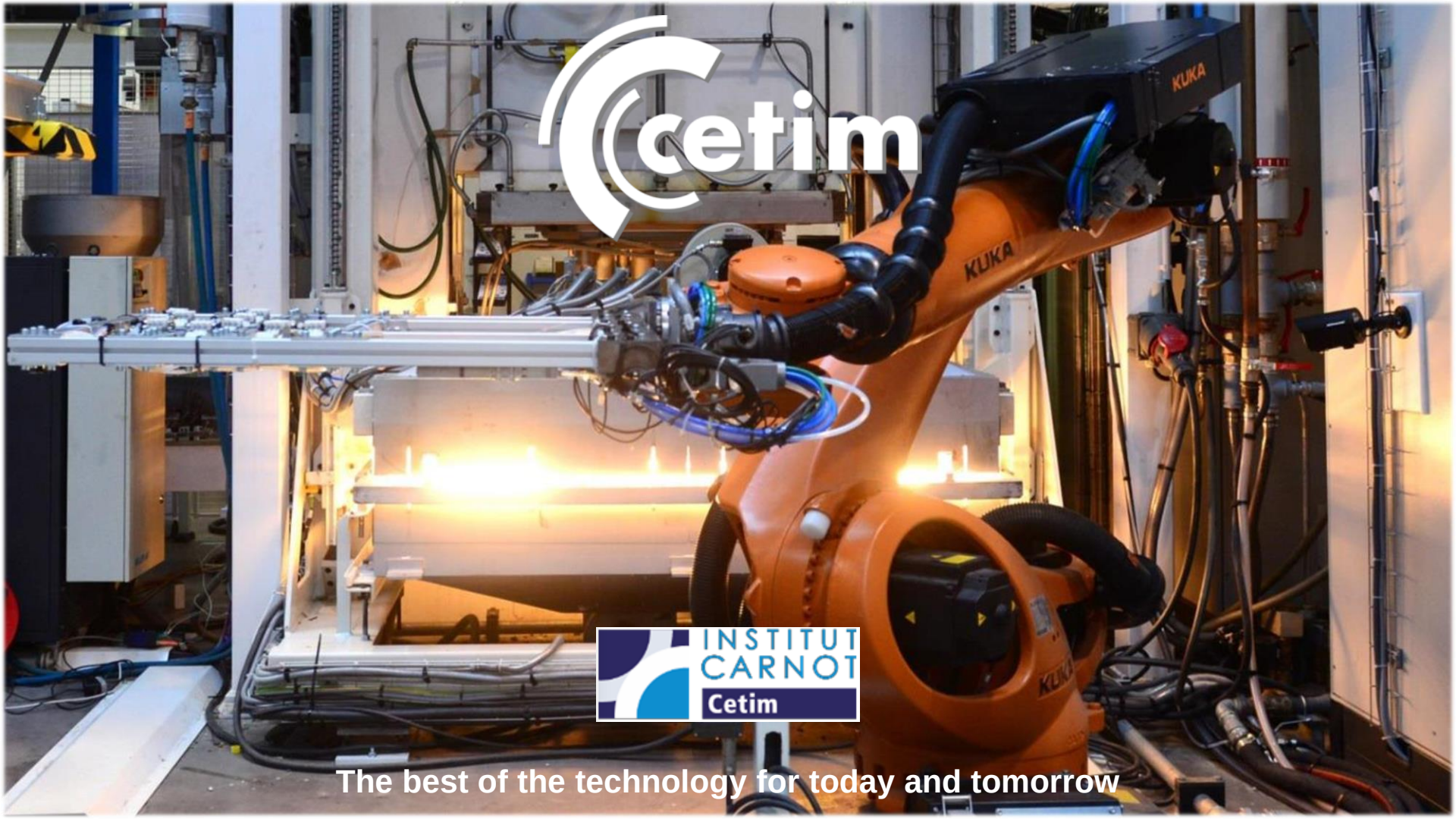

cetim
KUKA
INSTITUT
CARNOT
Cetim
The best of the technology for today and tomorrow

17 octobre 2018

AUTOMOTIVE CONNECTION 2018

Thermoplastic composites for automotive :
*a complete solution from design (**QSD®**),*
*optimized manufacturing (**QSP®**),*
*until recycling (**ThermoPRIME®** et **Thermosaïc®**)*

Cetim, the Technical Centre for Mechanical Industry

established in 1965 to improve companies' competitiveness

- 1st French research institute in mechanical engineering
- Main technology partner for Industry 4.0 roll out

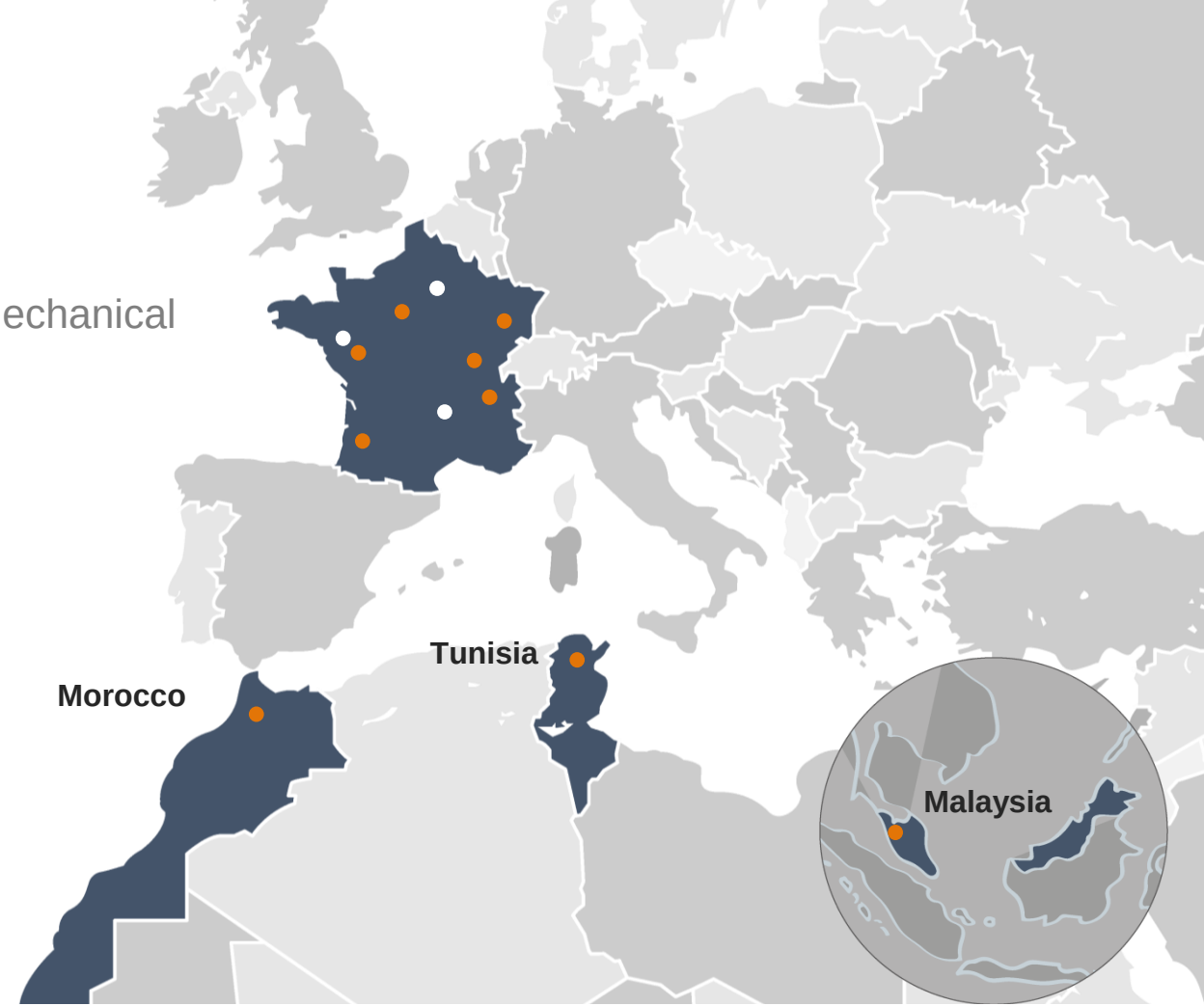
Mechanical engineering
Test laboratory, consulting and support

Advanced manufacturing solutions and services

Transfer and industrialization of innovations

Main locations

Multidisciplinary facilities
to support international mechanical industry…



Main figures

- 1,100 employees
- 70% Engineers
- 147 M€ turn over

Addressing more than 4 000 annual clients worldwide

Thermoplastic composites for automotive :

- **QSP®** : short cycle composite thermostamping process
- **QSD®** : advanced composite design and optimization toolbox
- **ThermoPRIME® et Thermosaïc®** : new recycling technology for TP composites

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Quilted Stratum Process® (QSP®) : an innovative concept

Design optimized, the right material at the right place :

- ✓ Multi-thickness parts
- ✓ Multi-orientation parts
- ✓ Multi-material parts

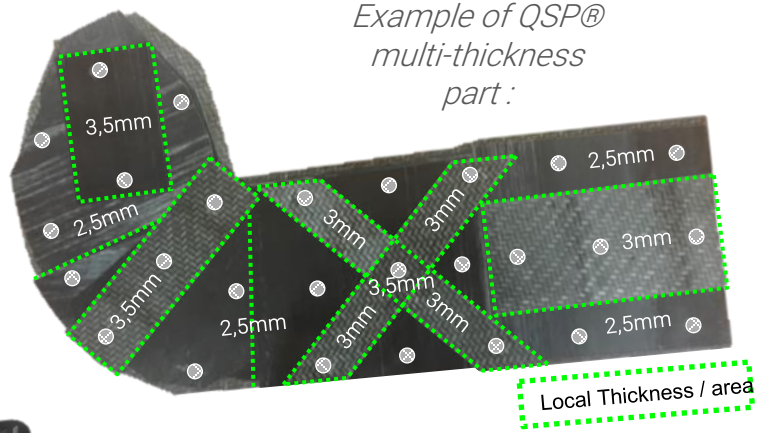
Netshape final parts for more added value :

- ✓ Global integration from raw material to final parts
- ✓ Low material scraps
- ✓ Assembly & functions integration

Production performance :

- ✓ Full automated cell from preform assembly to netshape part
- ✓ Short cycle time (40 to 120sec)
- ✓ Competitive cost

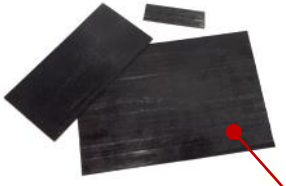
Example of QSP® multi-thickness part :

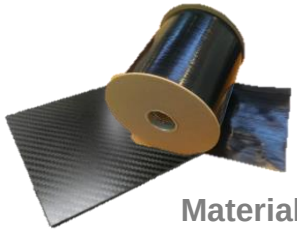


Quilted Stratum Process® (QSP®) – General view

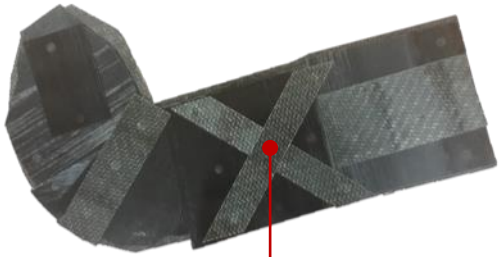
The process from fibers to finalized parts :

TP pultruded tapes

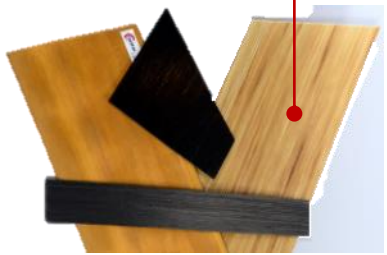




Material from the market



Automatic multi_thickness preform assembly



Cut plies

Thermo stamping + overmolding + in-mold assembly

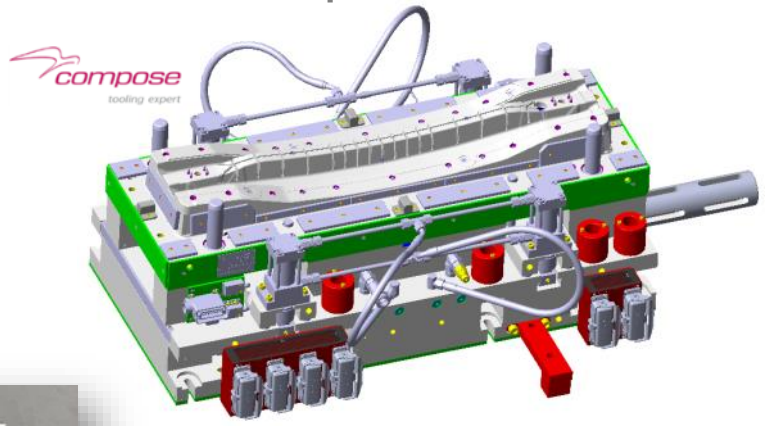
Quilted Stratum Process® (QSP®) – Video of the process

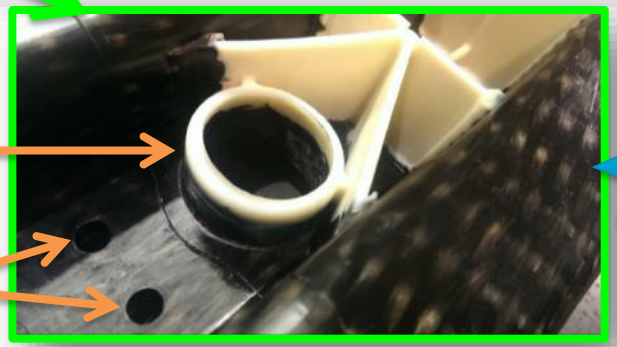
Lien Youtube : https://www.youtube.com/watch?v=h6if37hN6OM

QSP® : Example of mold industrialization on a bumper beam

Mold industrialization :

- ✓ Netshape part
- ✓ Stamping + overmolding in one step
- ✓ “one-shot” in-mold assembly for more added value and more mechanical resistance





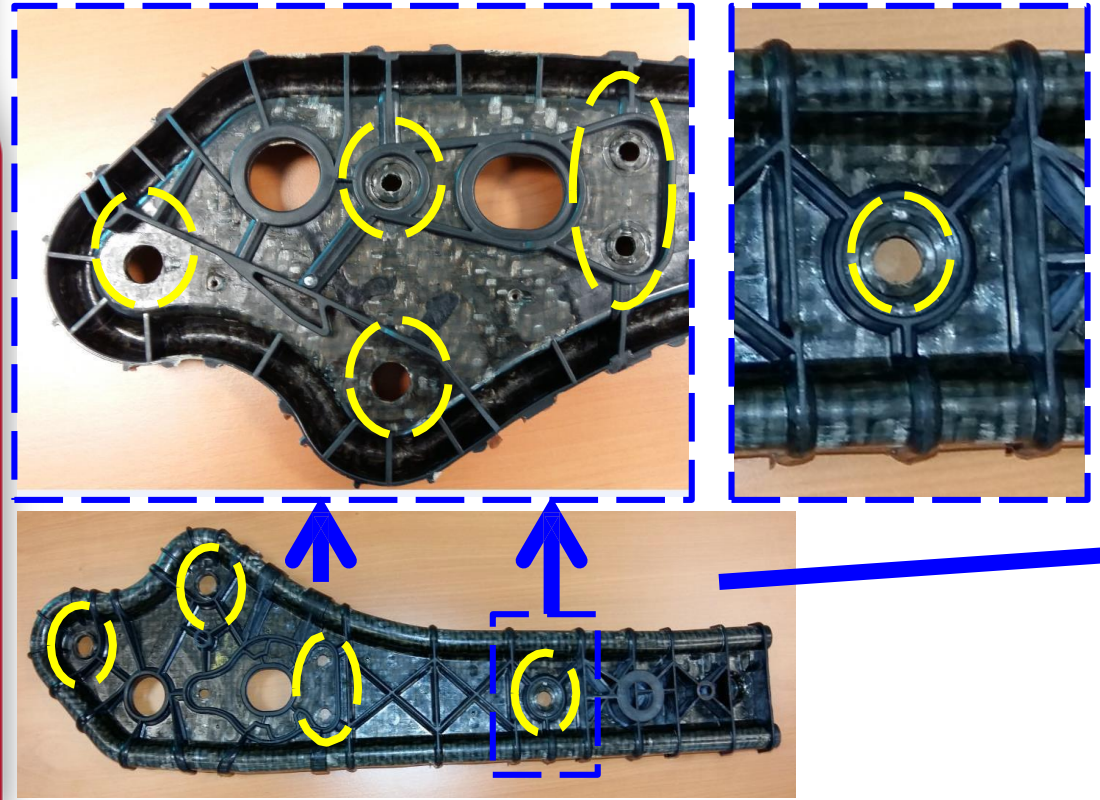
Example of one-shot hole in-mold Ø 27mm overmolded without pre-cutting
+
8 one-shot holes in-mold Ø 6,9mm

More “one-shot” in-mold solutions for more added value

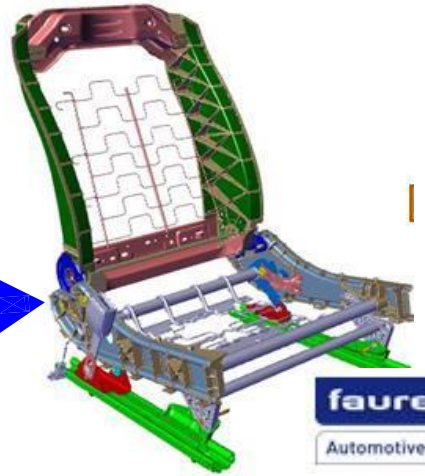
QSP® : part example with in-mold added value

Application of one-shot holes inmold on seat structure part *(DEMOS)*

***DEMOS project** : Faurecia (leader), **CETIM**, ECM, Mines Paristech, Lisi,, IFP, funded by ADEME (french government)*



Hole witout precutting on preform

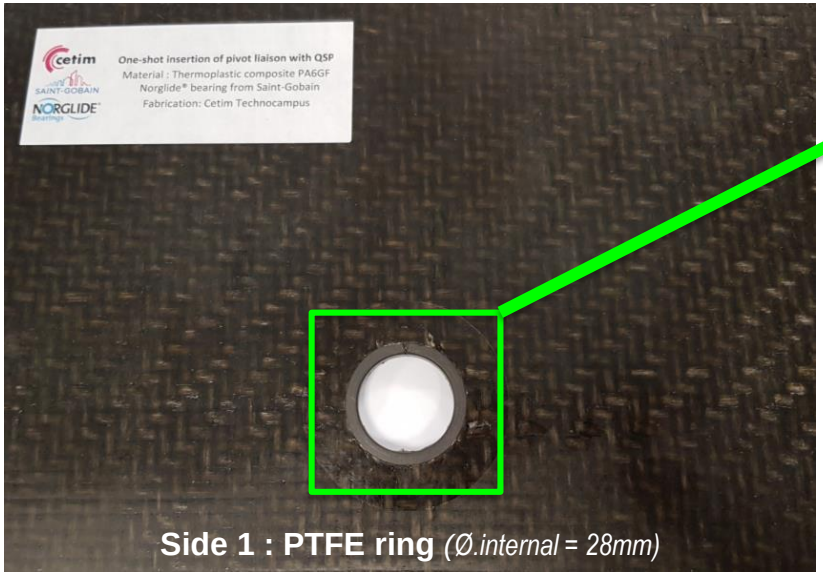


Faurecia / Cetim – JEC Conf 2016,03

QSP® : part example with in-mold added value

Application of direct insertion PTFE bearings into composite *(one-shot operation)* – SAINT-GOBAIN Bearings

- ✓ Stamping + bearing insertion + overmolding in one step
- ✓ No pre-hole needed for small diameters (≈ < Ø15mm)
- ✓ Pre-hole for big diameters (≈ > Ø15mm)



Side 1 : PTFE ring *(Ø.internal = 28mm)*

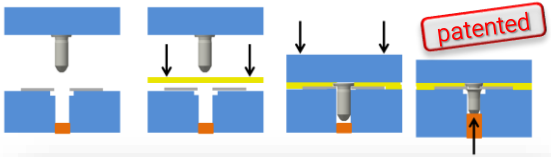
Side 2 : Ribs overmolded

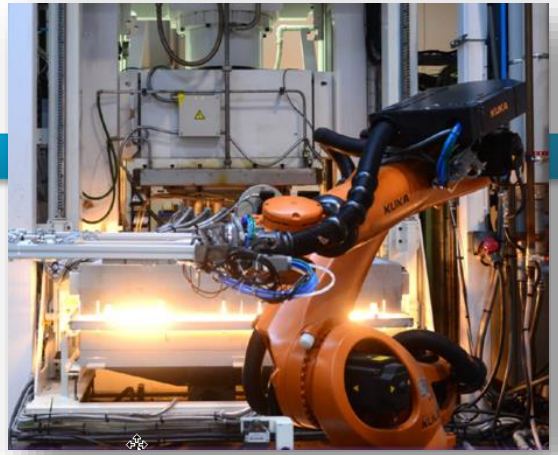
QSP® : New development for in-mold assembly

New **IMTEC® HR** designed for QSP® – ***H**igh mechanical **R**esistance fastener*

3 parts for the IMTEC® HR :
- RIVKLE®
- Metal Reinforcement
- Thermoplastic composite preform

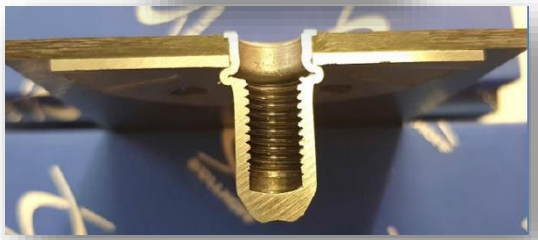
QSP® process :
- Stamping of the organo-sheet
- In-mold assembly of the fastener





Lien Youtube :
https://www.youtube.com/watch?v=h6if37hN6OM

Finished part - structural application :
- Netshape part
- Full integration in QSP® of IMTEC® HR



BOLLHOFF

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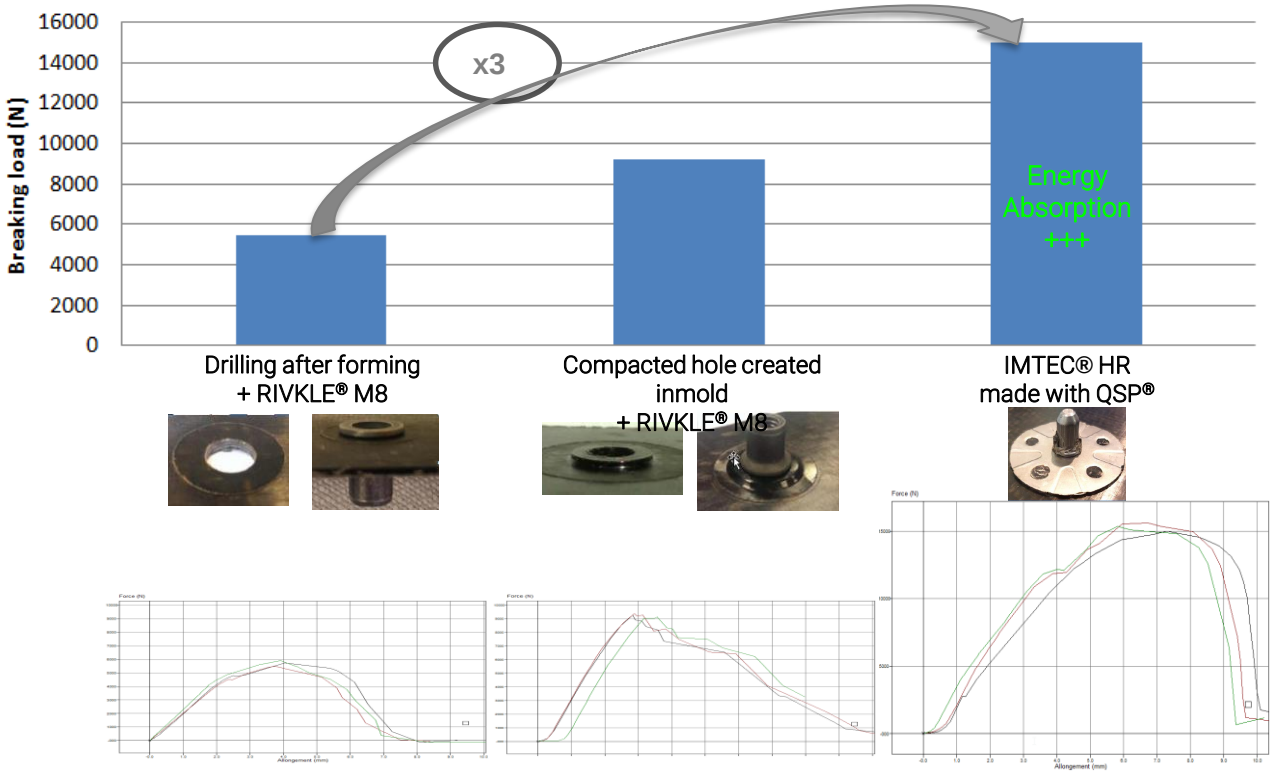
QSP® : New development for in-mold assembly

New **IMTEC® HR** designed for QSP® – ***High mechanical Resistance fastener***

Pull out tests



M8 thread – flange Ø60 – Hole for tests: Ø35mm

General **Key Benefits** of **QSP®**

Design optimization with QSD® :

- ✓ Freedom in material choice *(Mix UD tapes, laminates…)*
- ✓ Multi-materials design *(local integration of carbon patches, overmolding short fibers…)*
- ✓ 0% scrap design possible

Weight reduction with QSP® :

- ✓ **Reduction up to 25%** of composite use compared to mono-thickness part

Process optimization with QSP® :

- ✓ Reduction of global material waste from 40-50% to 0-15% **= Cost effective**
- ✓ A maximum added value on parts (one-shot assemblies in-mold) **= Cost effective**
- ✓ In line process / automation **= high volume production**
  - ❖ From 1 to 5 min cycle time for a net shape part

Thermoplastic composites for automotive :

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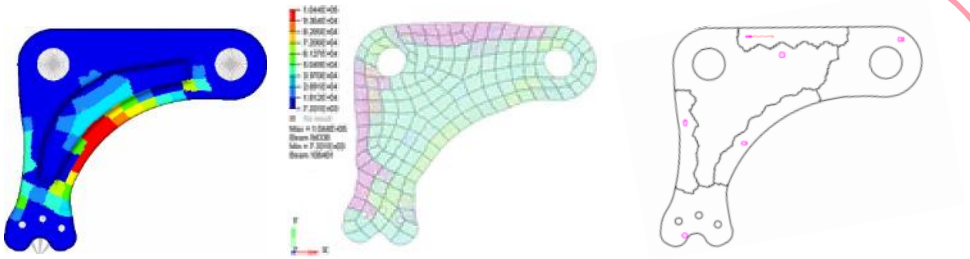
Quilted Stratum Design (QSD®) : 3-steps Design to Cost optimization

Part base FEA + CAO



Composite optimisation

- Advanced optimisation method
- Multi criteria
- Auto / user zoning
- Altair Hyperworks / Optistruct

Altair

Shape / Forming

- Shape constrains integration
- Work on flattened shape

Patching study

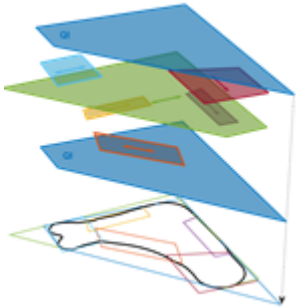
- User material database
- Stiffness matching method
- Cost evaluation with :
  - Patching strategies
  - Scraps costs

QSD®

cetim

ONERA

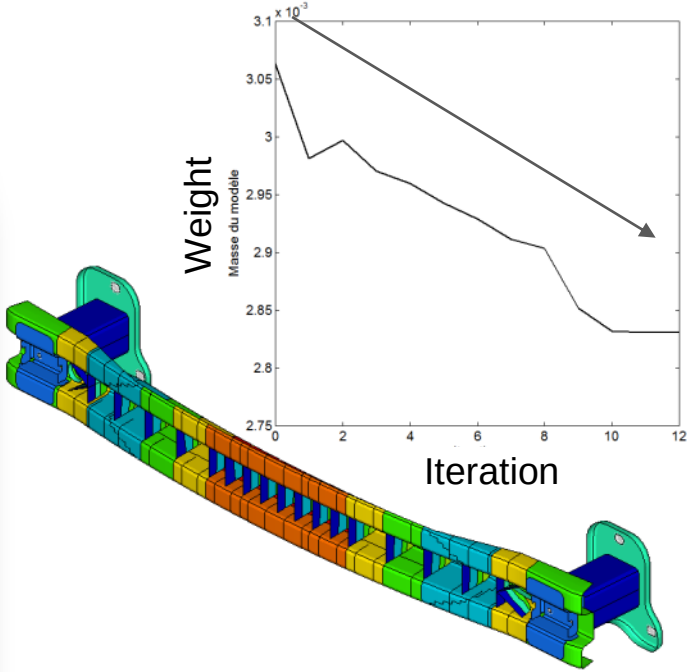
THE FRENCH AEROSPACE LAB

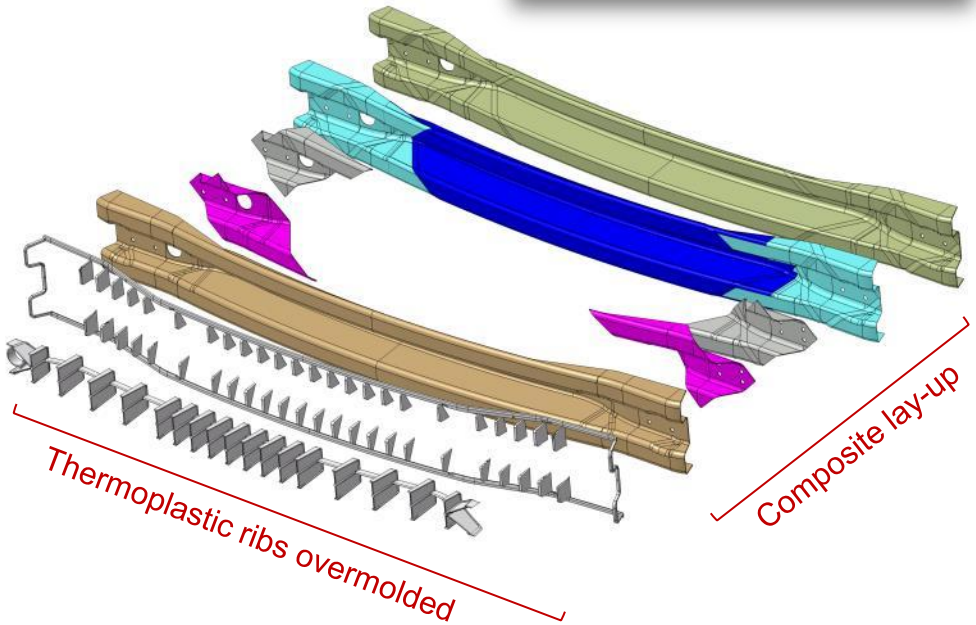


Multi-material
Multi-thickness
optimized
stacking sequence

Quilted Stratum Design (QSD®) : design methodology

Methodology applied on automotive front bumper beam





Optimization results :

- ✓ Multi-patches with local anisotropy :
  - ❖ Multi-materials
  - ❖ Multi-thickness

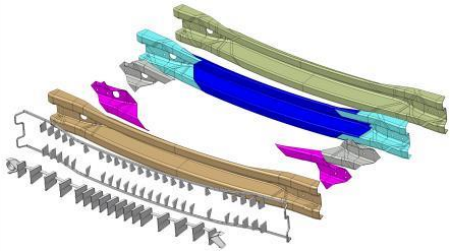
General QSD® - QSP® **Skills & Services**

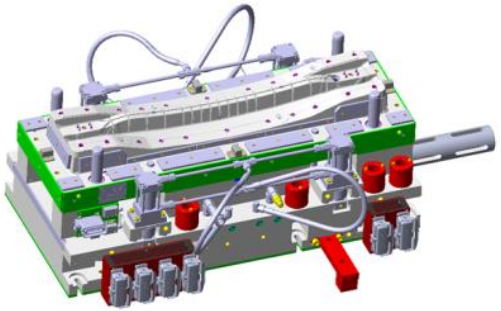
Cetim: Product & Process Development

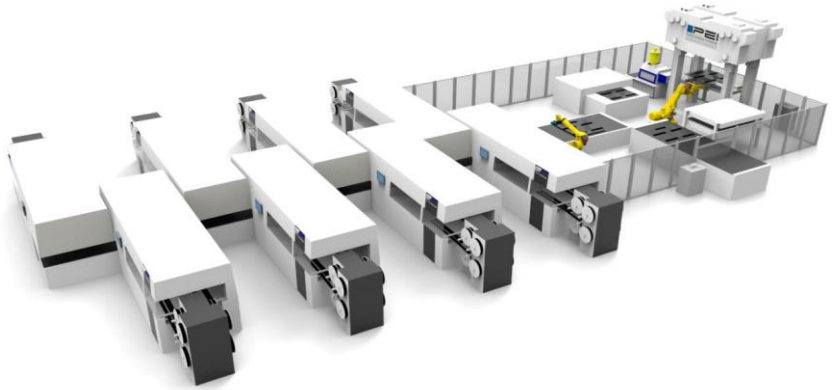
- ► Material Qualification,
- ► Product Design,
- ► Product Testing,
- ► Prototype Manufacturing,
- ► Quality evaluation / NDT
- ► Validation

Pinette Emidecau Industries: Industrial Engineering & Support

- ► Full line design & Supply,
- ► Automatic Tape cutting,
- ► Automatic Preform assembly,
- ► Heating, Forming and overmolding,
- ► **Loiretech:** Preform Heating System
- ► **Compose**, Tooling Design & supply







Thermoplastic composites for automotive :

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ThermoPRIME® and Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

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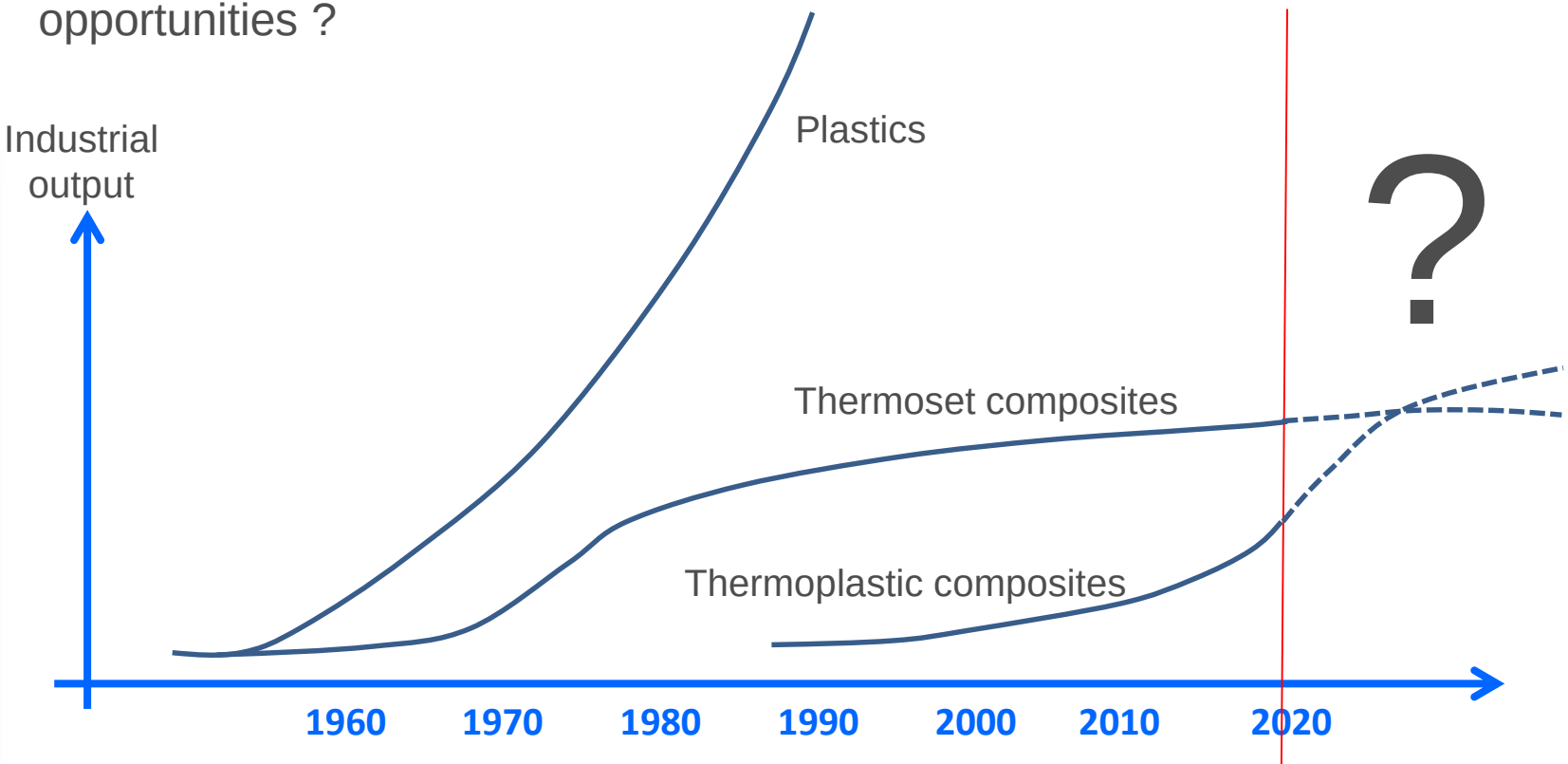
JEC WORLD INNOVATION AWARDS WINNER

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

Plastics and thermoset/thermoplastic composites : which trends and opportunities ?



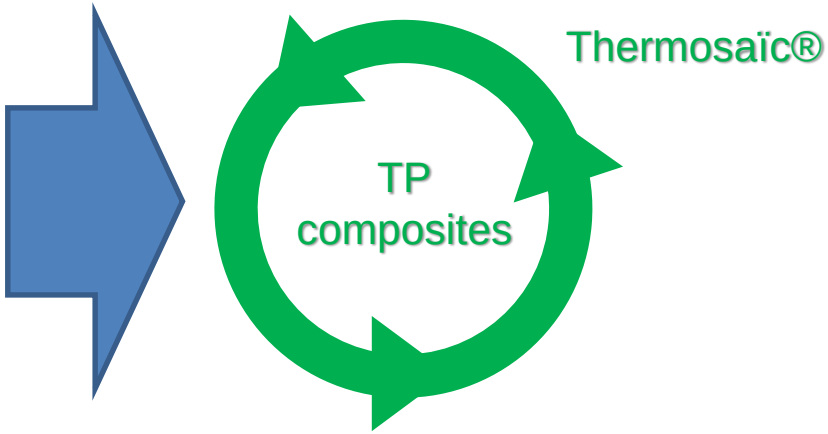
ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

Plastics and thermoset/thermoplastic composites : which trends and opportunities ?

Thermoplastic composite waste ➔ a new recycling opportunity

Production waste

End of life waste



Sources of information : Cetim, Consoglobe.com

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

ThermoPRIME® technology : an up-cycling approach for plastic waste

Key information about ThermoPRIME® technology

- ✓ Cost effectiveness process, low environmental impact
- ✓ Convenient for any kind of recycled thermoplastic (rPP, rPA…)
- ✓ **Recycled plastic + long or continuous reinforcement (mat, fabric…) ➔ composite panel (laminate)**

« Plywood-like » structure

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

Thermosaïc® technology : a new recycling approach for thermoplastic composite waste

Key information about Thermosaic® technology

- ✓ Cost effectiveness process, low environmental impact
- ✓ Convenient for any kind of thermoplastic composite waste
- ✓ **Scraped thermoplastic composite ➔ composite panel**

« OSB-like » structure

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

Thermosaïc® technology : a new recycling approach for thermoplastic composite waste

Thermo-mechanical process ➔ recycled composite panels production

Patented

Pilot line

Thermosaïc® composite panels

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

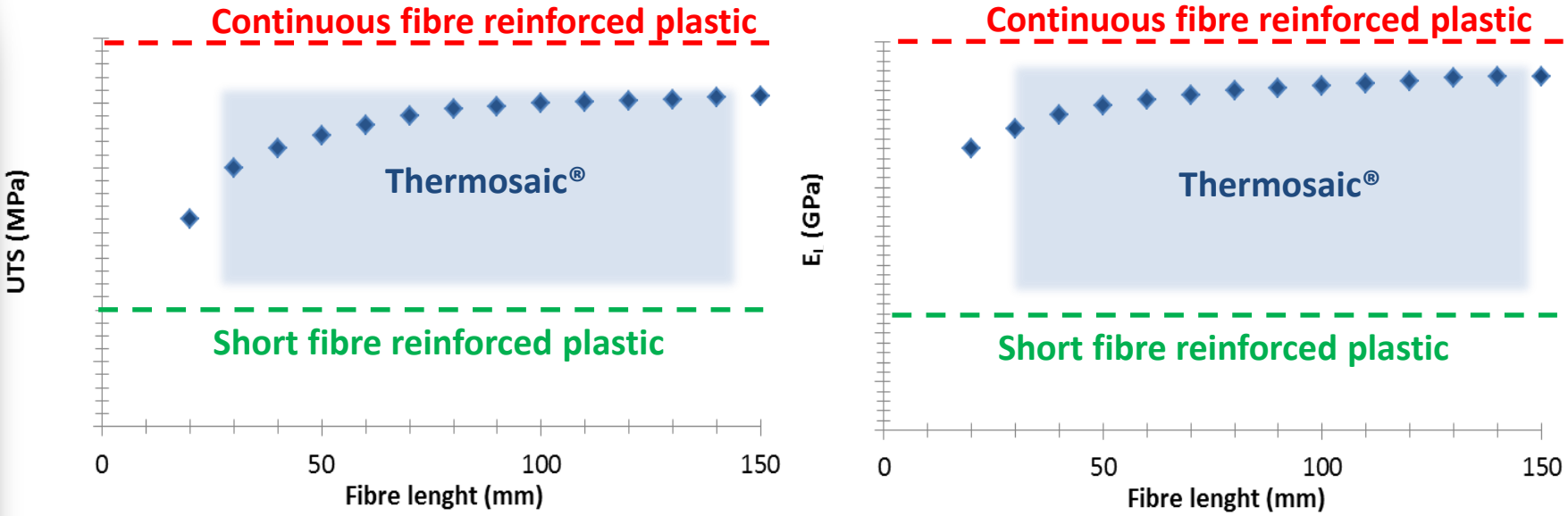
Thermosaïc® technology : a new recycling approach for thermoplastic composite waste

- ✓ **No separation between polymer matrix and fiber reinforcement**

- ✓ Mechanical properties of recycled material mostly maintained
- ✓ Composite panels ➔ isotropic mechanical properties
- ✓ Composite panels ➔ high formability potential

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

Thermosaïc® technology : a new recycling approach for thermoplastic composite waste



Source : Global trends, from Kelly&Tison and Cox models (PP/GF)

ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

Thermosaïc® technology : a new recycling approach for thermoplastic composite waste

Recycled composite panels adapted to traditional processing techniques

- ✓ cutting
- ✓ folding
- ✓ welding
- ✓ machining
- ✓ stamping
- ✓ thermoforming
- ✓ …

Riveting, welding, stamping of Thermosaïc® composite panels (PP/GF)

JEC Award Paris 2018
Sustainability category

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ThermoPRIME® Thermosaïc® technologies : 2-in-1 line for high performance recycled thermoplastic composites manufacturing

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French version :
https://www.youtube.com/watch?v=hjo7Wu3suLc

English version :
https://www.youtube.com/watch?v=nGfWQSKjKc8

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PLASTIFORM SOLUTIONS THERMOFORMÉES

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Pôle Véhicule du Futur Solutions pour véhicules & mobilités du futur

Do you need more details ?
Contacts

Centre Technique des Industries Mécaniques

sqr@cetim.fr

Phone : +33 (0)3 44 67 36 82

Clément Callens

BU manager Industry of the Future

CETIM GRAND EST

clement.callens@cetimgrandest.fr

phone : +33 (0)6 73 08 90 77

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