INNOVATION
PLASTURGIE
COMPOSITES

THE SMART COMPOSITES PLATFORM TOWARDS ADVANCED FUNCTIONALIZATION OF SMART LIGHTWEIGHT COMPONENTS FOR AUTOMOTIVE AND AERONAUTICS

March 14th, 2018

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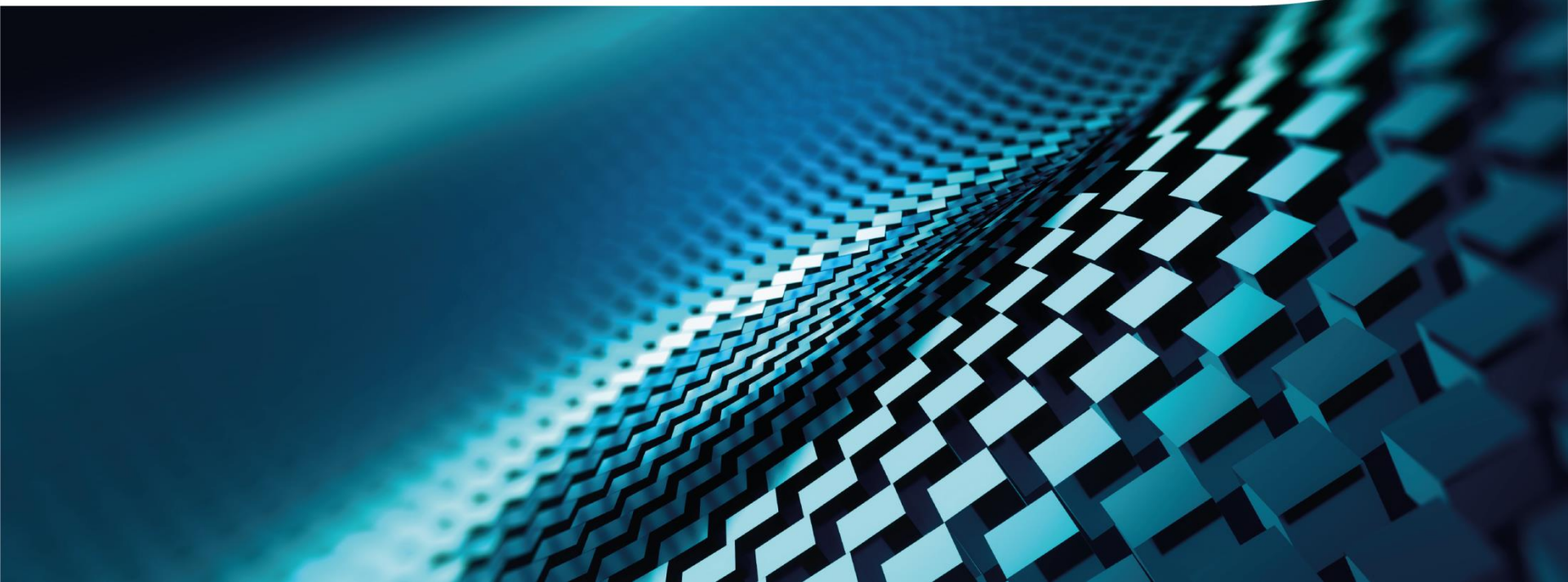
R&D Programmes Manager

IPC AT A GLANCE

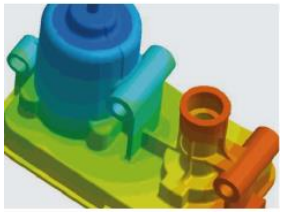


INNOVATION PLASTURGIE COMPOSITES

IPC, established December 1st 2015, is the French Technical Centre for Innovation and Expertise in support of Industry.

Opened to industrials, IPC takes part in the setup of partnerships and helps to create synergies between actors of the plastics and composites branches.

OUR OBJECTIVES
Improving the competitiveness of the industry through innovation
Giving access to latest technological means for industrials.



EXPERTISE RESEARCH & DEVELOPMENT

Our activities

- R&D
- Services
- Collective actions
- Training

Our competencies

- Materials
- Design & simulation
- Processes & tools
- Smart Hybrids

INNOVATION PLASTURGIE COMPOSITES

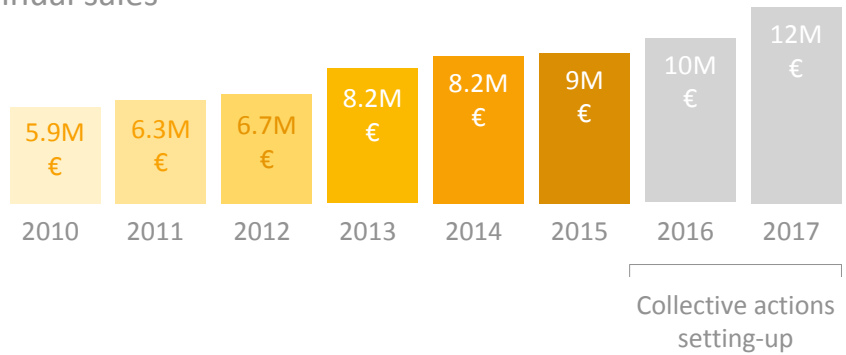
IPC is established in seven locations in France.

INNOVATION PLASTURGIE COMPOSITES

130 employees (researchers, engineers, technicians): multi-competencies teams

Market share

Annual sales



Services for companies

40 %

Research & Development
(private R&D or collaborative projects)

60 %

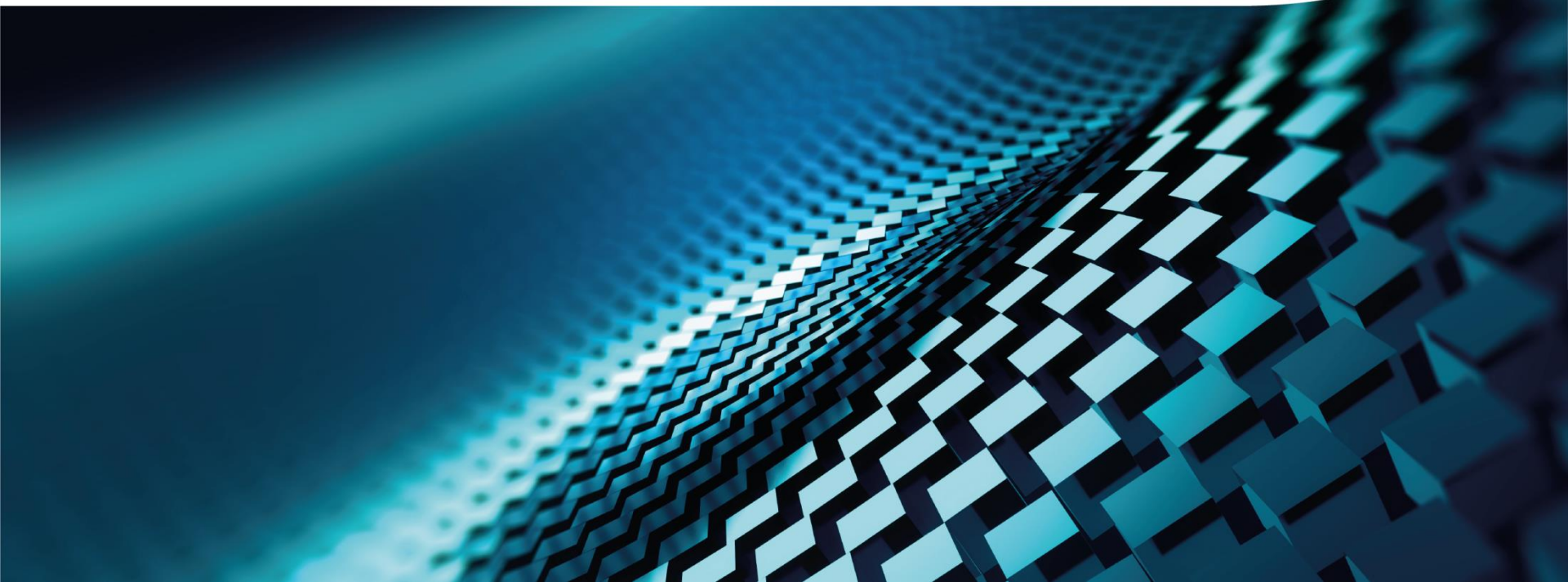
Our certifications

CIR
Agréé Crédit
Impôt Recherche (CIR)

SGS
Certifié ISO 9001
v2008

COFRAC
ISO 17025

POLYMER-BASED STRUCTURAL LIGHTWEIGHT COMPONENTS: OPPORTUNITIES & STAKES



Towards advanced functionalization of lightweight components

- Parts' integration
  - Take advantage of moulding possibilities of composites and plastics parts
  - Replace several metallic parts by one composite part

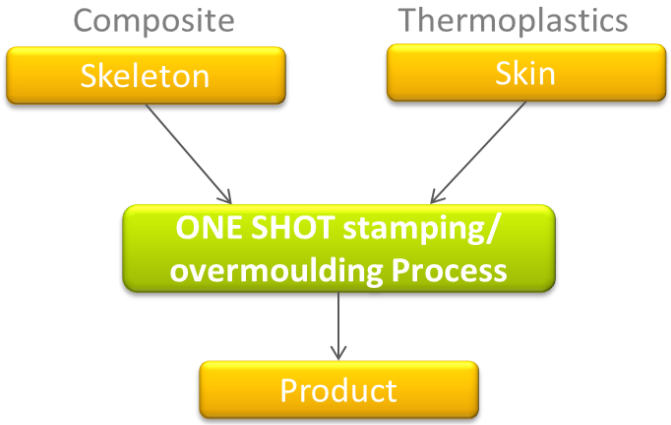
- For
  - Lightweighting : Thanks to specific mechanical properties
  - Cost reduction : By limiting the number of assembly steps

- Answering the demand for lightweight and high-performance products requires high-level skills and facilities throughout the value chain

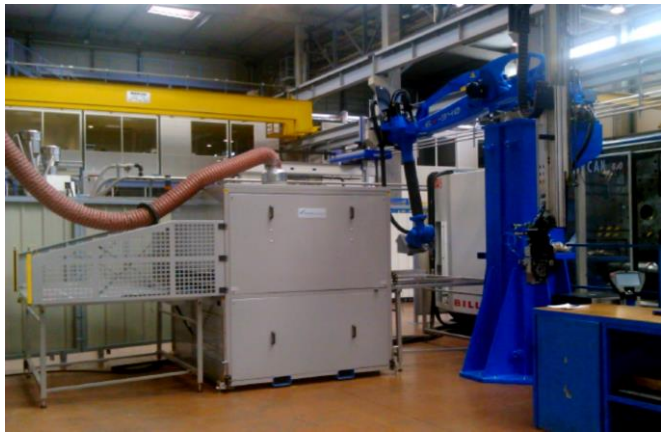
➢ NEW MARKETS' NEEDS AND DEVELOPMENT
- **➢ Multi-material integration**
- **➢ New functions' integration**

Polymer-based structural parts

- Production of semi-structural and structural parts at high rates
  - Combine mechanical resistance and design freedom
  - Decrease cycle time
  - Net-shape processing



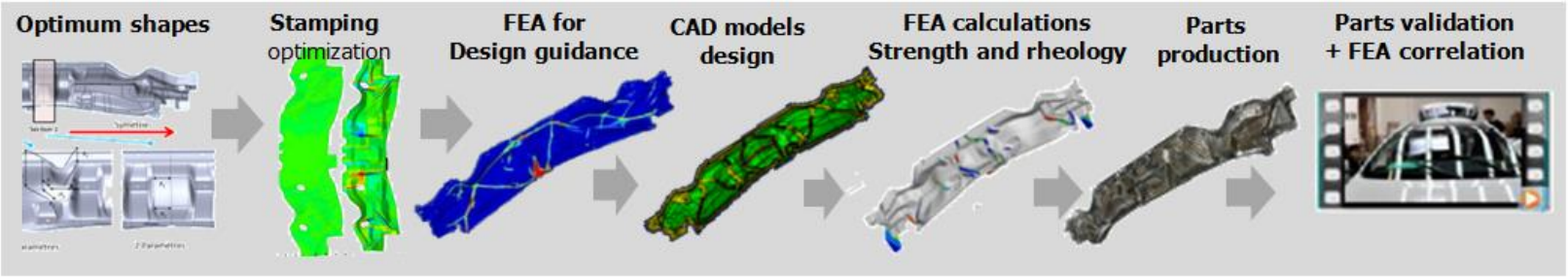
"STIICPA" Project



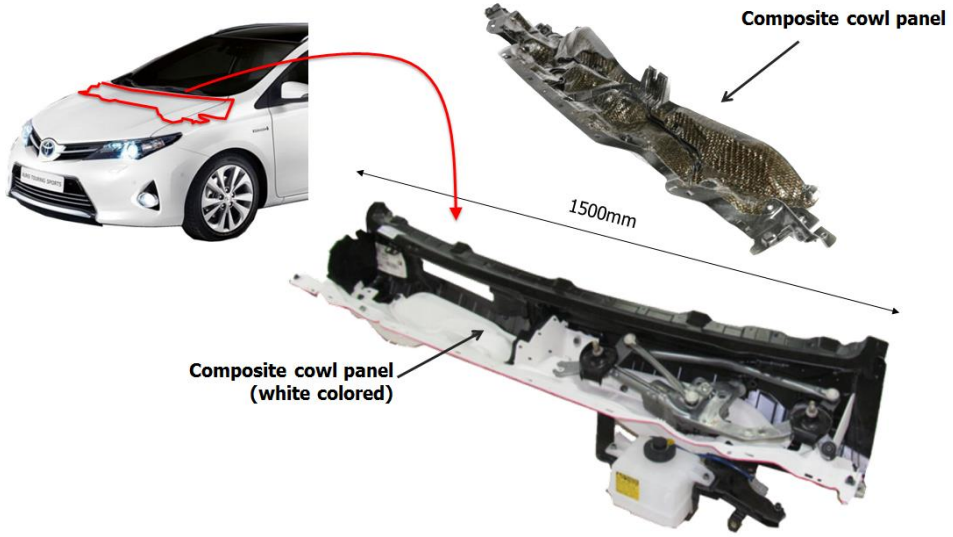
- Processing issues
  - Temperature management throughout cycle
  - Composite handling (gripper/mould)
  - Mould kinematics for complex shape forming

Polymer-based structural parts

- « Hybrid » carbody inner part
  - New design using organosheet overmoulding
  - 40% mass saving

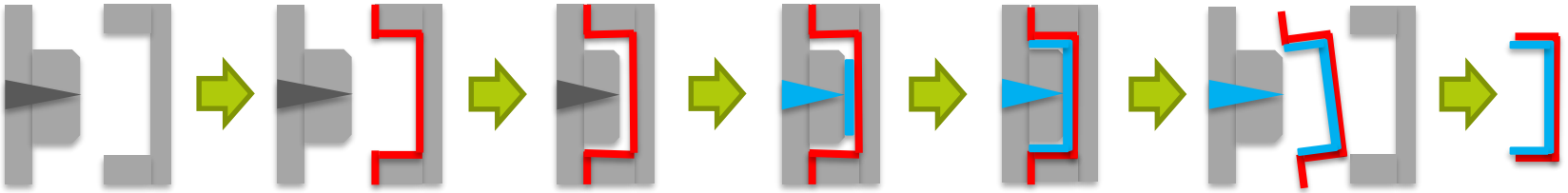


- Main innovations
  - Large and thin part
  - Local reinforcement
  - No composite loss



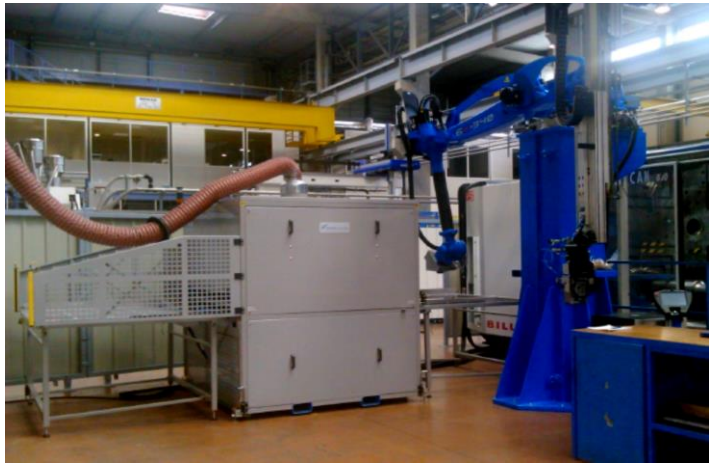
Polymer-based structural parts

Process flow



1. *Mold opened* | ***2.*** *Organosheet in the mold* | ***3.*** *Mold closed* | ***4.*** *Polymer injected* | *5. Cooling* | ***6.*** *Part ejection* | ***7.*** *Final part*

Infra-red oven
with multiple setup (32 areas)



1600 T injection machine equipped
with a 6-axis robot

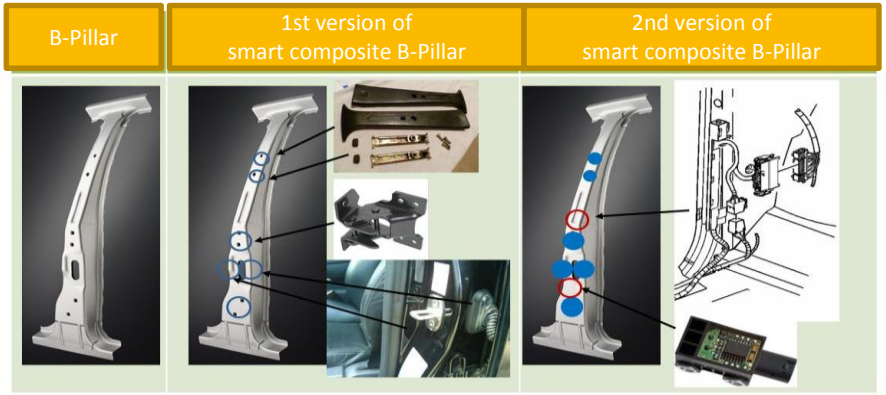
Polymer-based structural parts

- COMPOSTAMP project

Economical stakes

Economical analysis

- Composites solutions cannot meet economical balance vs metals in some applications
- Need for further developments in products' design
- Intense R&D effort to sink costs (materials, processes, simulation)



Still, cost objectives can only be met with further integration

→ **electronical + mechanical**

- **ELECTRONIC INTEGRATION IS AN OPPORTUNITY FOR COMPOSITES**
- **COMPOSITES ENLARGE POSSIBILITIES FOR ELECTRONIC INTEGRATION**

Need for multi-functionality: example in the aeronautic sector

SECURITY & PREDICTIVE MAINTENANCE
SHM (impact & cracks detection)
Motor monitoring

ENERGY HARVESTING

ENHANCED COMMAND
Human-machine interfaces

IMPROVED OPERATION
De-icing

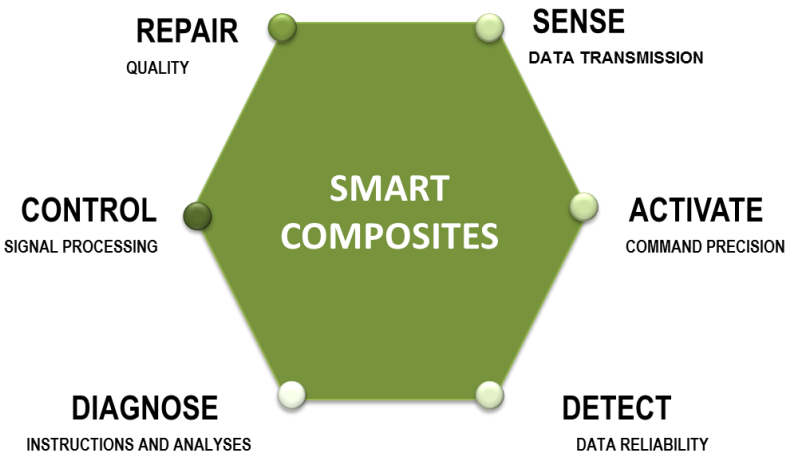
COMFORT & AGILITY
Vibration damping
Cab soundproofing
Lighting

PARTS IDENTIFICATION
Anti-counterfeiting
Recycling

ACTIVE DRIVE
Active aerodynamics

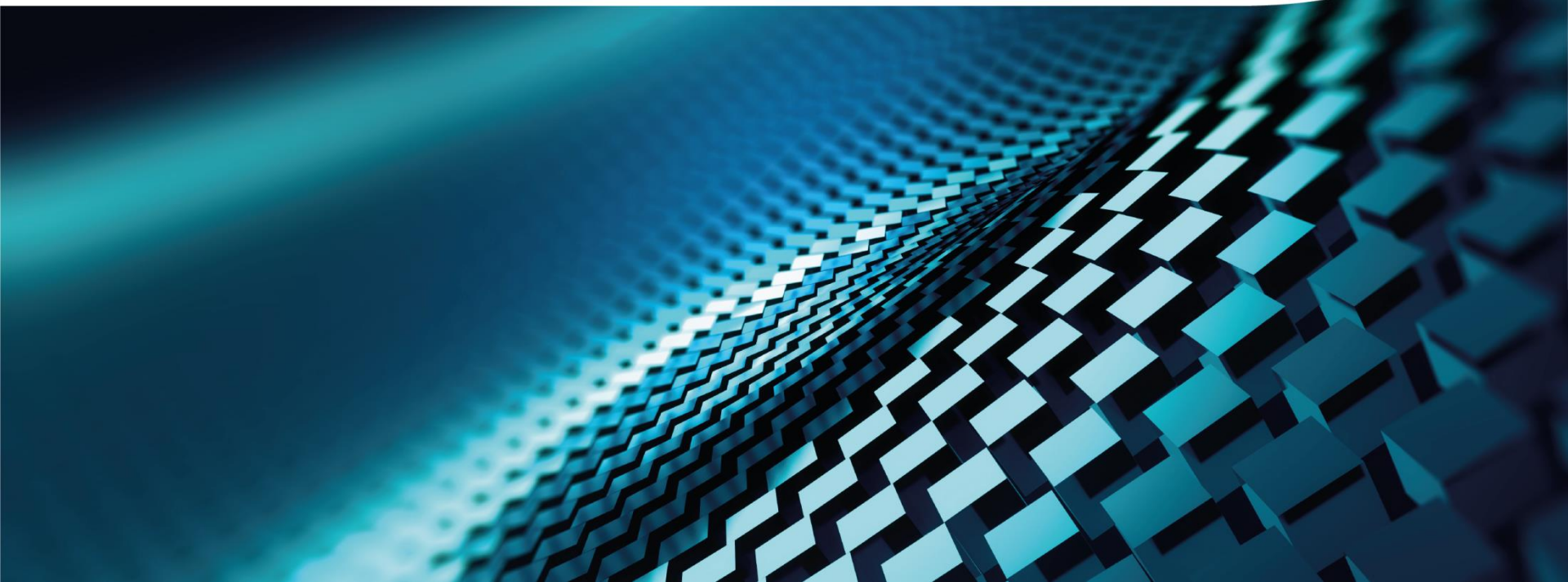
Electronic integration: an opportunity for composites

- Additional functionalities
  - Parts identification & monitoring
    - Anti-counterfeiting
    - Enhanced security
    - Predictive maintenance
    - End-of-life management
  - Comfort enhancement & autonomous operation
    - Lighting
    - Thermal management
    - Human-machine interfaces
  - Energy harvesting

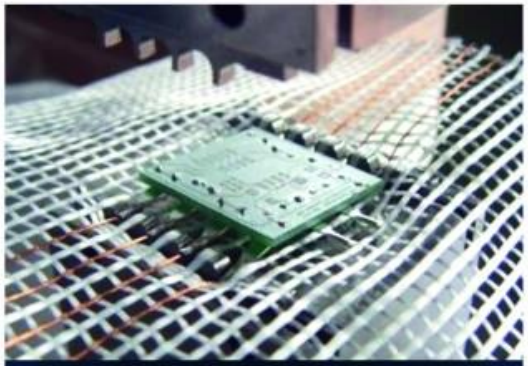


- Improve composite cost balance at component or sub-assembly level

TOWARDS ADVANCED FUNCTIONALIZATION OF SMART LIGHTWEIGHT COMPONENTS

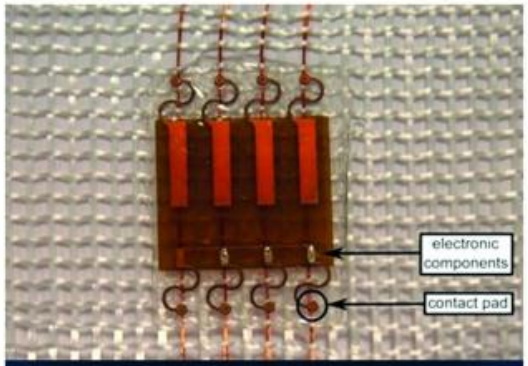


Components



PCB

Source : projet européen PASTA

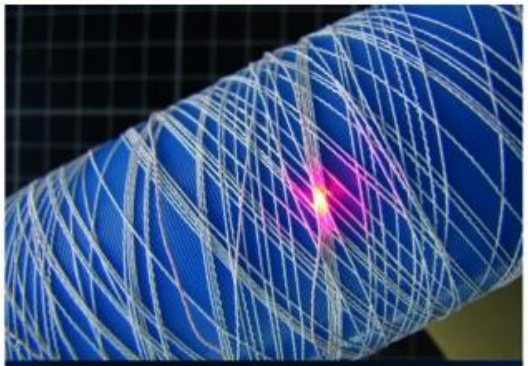


Stretchable electronics

Source : projet européen PASTA

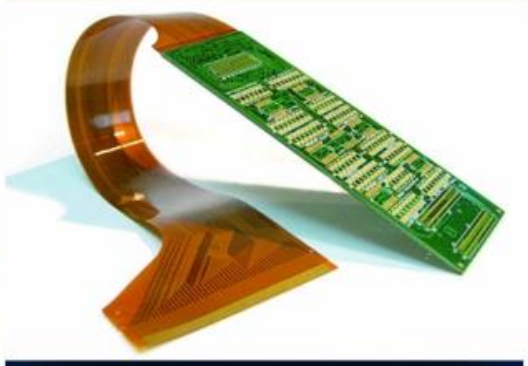
Printed electronics

Source : Thinfilm

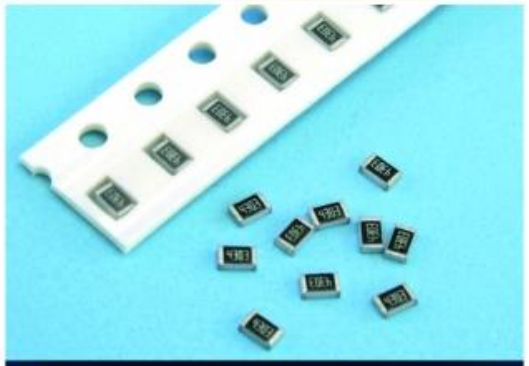


Functional thread

Source : Primo 1D



Flex-PCB



Surface Mounted Devices

Technologies for electronic integration

- Overmoulding / Co-moulding
  - Conductive metallic inserts
  - Flexible electronics
- Wide array of solutions & components

- Laser Direct Structuring (LDS®)
  - Components miniaturization & count reduction
  - 3D design freedom

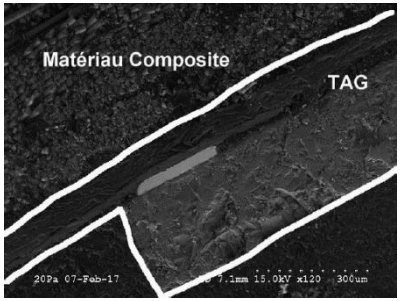
- Functional constituents
  - Conductive resins (ESD, conduction)
  - Electronics / conduction on reinforcement
- Use fibres & matrix for functions

Primo1D
The E-Thread® Company

- Additive manufacturing
  - Metallic inserts
  - Printing sequence including component introduction
  - Conductive inks
- Wide array of solutions & components

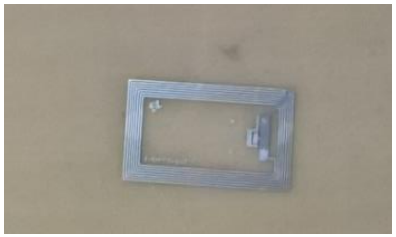
Overmoulding for electronic integration

- Process study

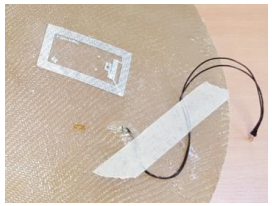


INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

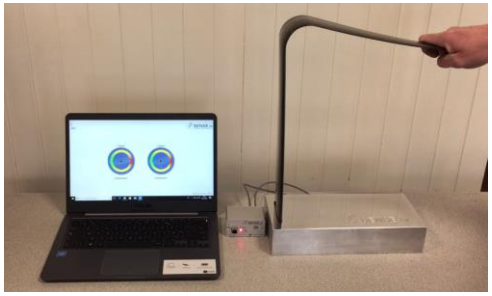
- Influence of reinforcement nature



- Design rules



Connected chistera

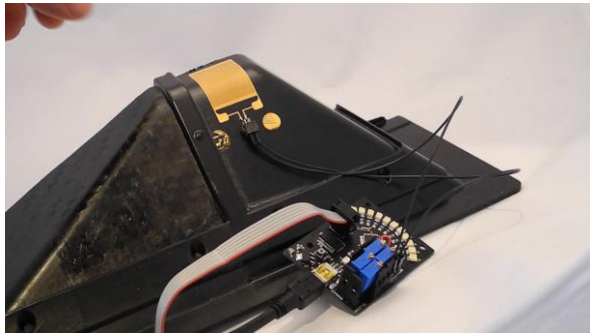


Connected foil

Post-processing approach

Function description

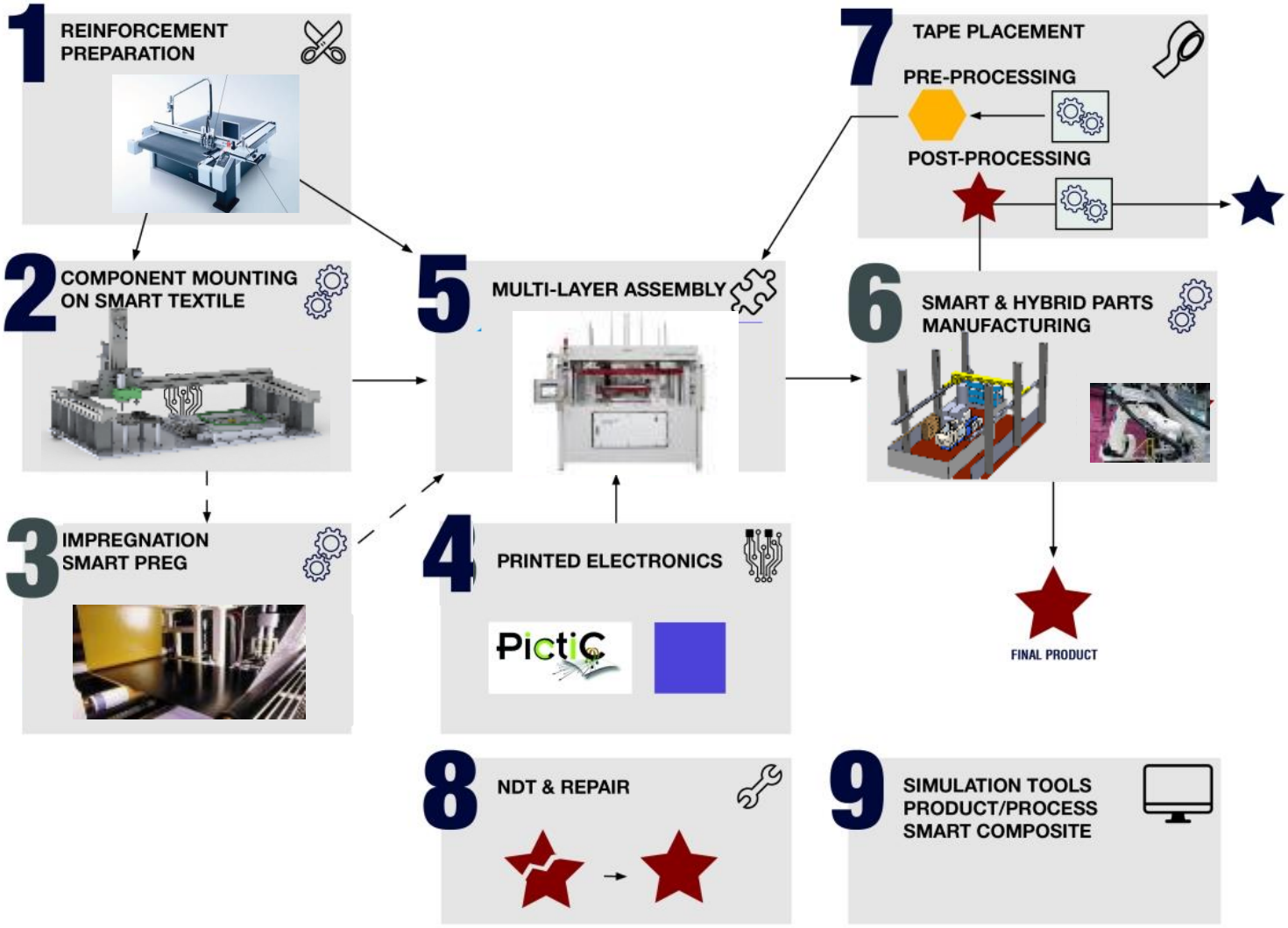
- Part obtained with hybrid process, potentially painted
- Strain gage is «printed» on part thanks to Laser Direct Structuring®
  - Surface « component »
  - Customised design



Technology advantages

- Direct implementation of gage → accurate & non-intrusive measurement
- 3D design freedom → allows for complex measuring devices and connecting tracks

The HYPROD² platform



THANKS FOR YOUR ATTENTION !

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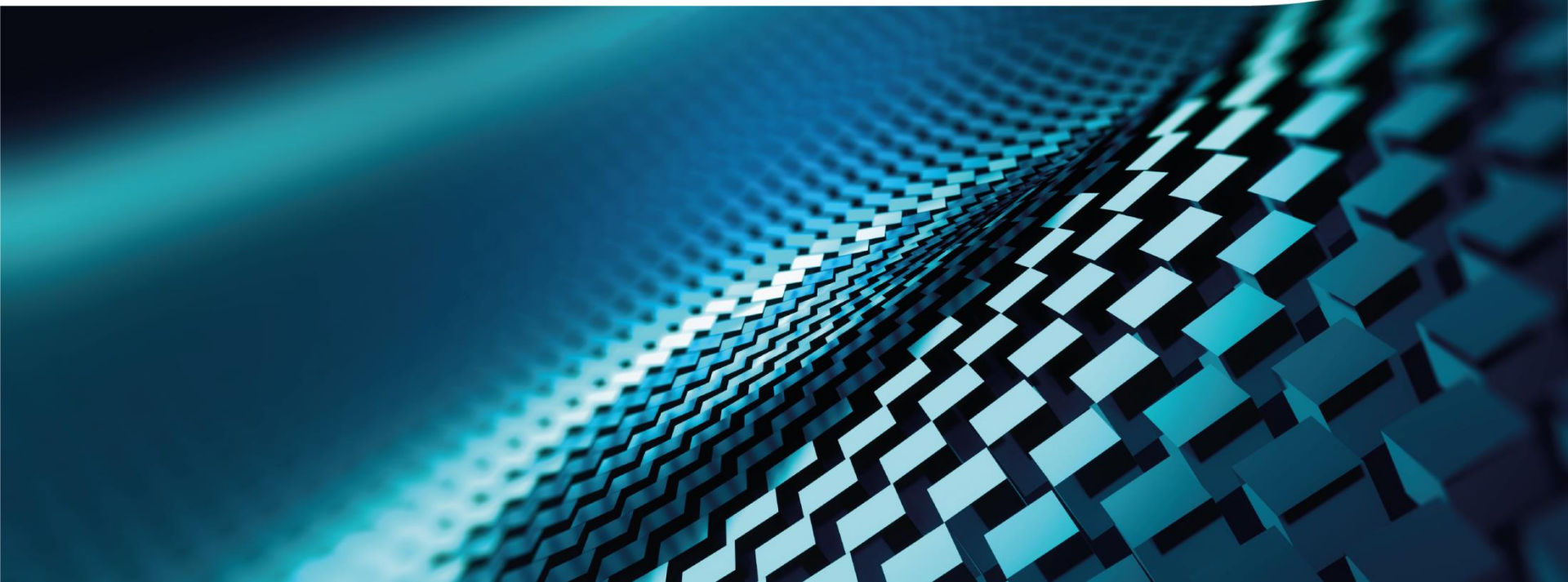

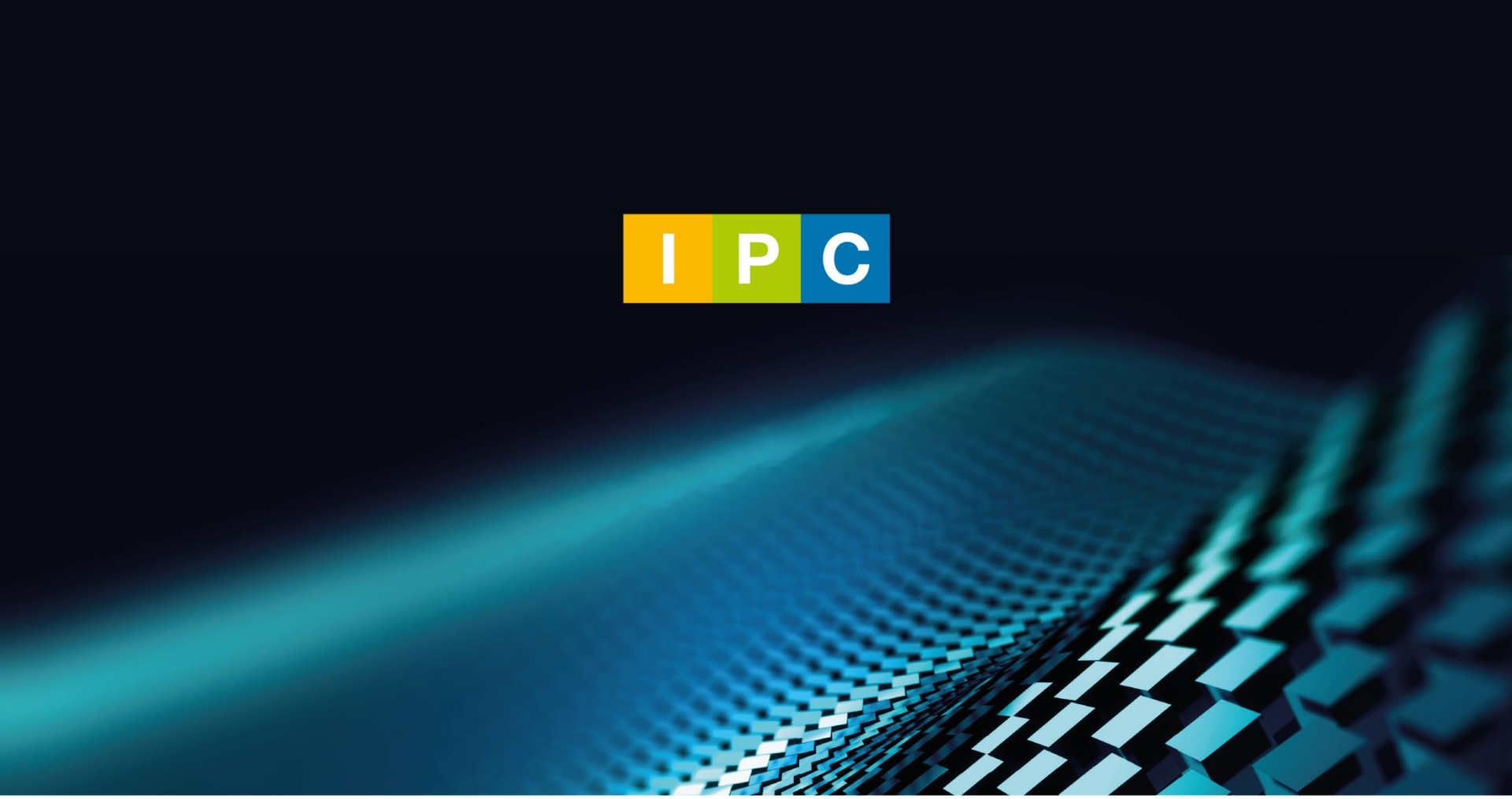

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