AACOMA

Interreg Euregio Meuse-Rhine AACOMA

EUROPEAN UNION European Regional Development Fund

Demo project #5

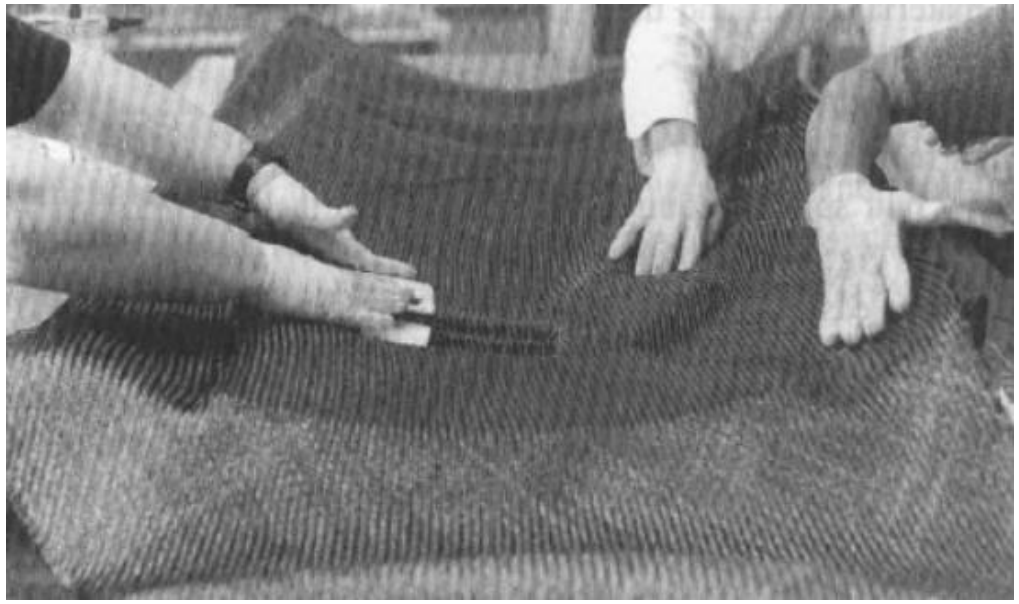
Robotics & Augmented reality in composite manufacturing

Lead partner: ULiège

Wallonie · provincie Limburg · Provincie Noord-Brabant · Ministerie van Economische Zaken en Klimaat · CENTEXBEL · sirris · LIÈGE université · FLANDERS MAKE · AM Biobased Materials · Fontys University of Applied Sciences · AMAC Advanced Materials Advisory & Consultancy

Motivations

- Composites: excellent mechanical performances, many applications, steady growth
- Increased demand for **cost-efficient manufacturing methods**
- But at present, manufacturing techniques remain costly



Skilled manual labour still necessary

Manual ply lay-up can represent **40 to 60%** of the total cost of hand lay-up techniques

Increases costs, scrap rate, lead time, lowers repeatibility

Goals of the demonstrator

- Foster the dissemination of composites in more areas
- Convince that flexible and affordable automation solutions exist
- Robotics to automate processes: draping and induction welding
- AR to assist in manual steps: assembly, process monitoring
- Show proof of concepts on real cases and provide recommendations

Tasks & Workplan

Interreg Euregio Meuse-Rhine AACOMA — EUROPEAN UNION European Regional Development Fund

Robotics

Smart gripper development

Manipulation of dry fabrics (draping)

sirris Induction welding on 3D shapes

High-level user interface — FLANDERS MAKE

Robotic cell integration and validation

AR

Augmented reality solutions

sirris Data visualization

sirris 3D models for assembly

Evaluation of KPIs, cost benchmarking, practical recommendations — sirris

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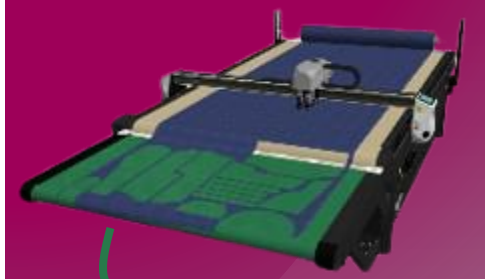
Smart gripper development ⟷ Draping of dry fabrics

1

CUTTING OF FABRICS



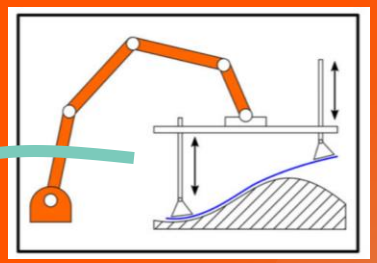
Dry fabrics

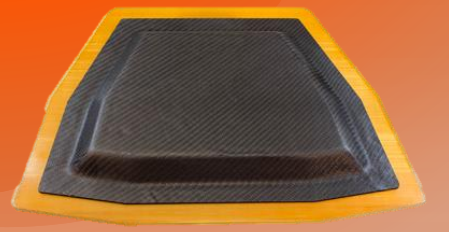
2

GRASPING

3

DRAPING

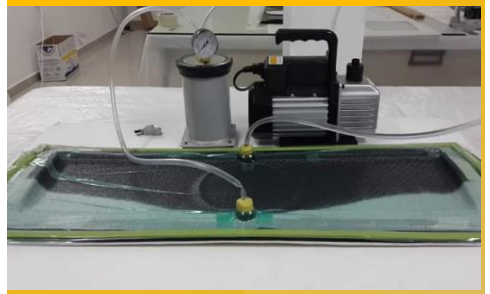




Flexible gripper:
- Adapts to different fabric shapes
- Can deform to deal with 3D mold

4

VACUUM INFUSION



CENTEXBEL

General workplan

Robotics

Composite repair demonstrator

sirris
Induction welding on 3D shapes

AR

Augmented reality solutions

sirris
Data visualization

sirris
3D models for assembly

Robot

Task description
Integration of an induction coil on robotic arm.
Robot programming and preliminary testing on simple shapes.
Welding of more complex geometrie (3D shapes), curved pieces to bind together
Production of demo pieces (interaction with FM's composite repair demo)

Evaluation of KPIs, cost benchmarking, practical recommendations

sirris

General workplan

Robotics

Smart gripper development

Manipulation of dry fibers (draping)

sirris
Induction welding on 3D shapes

Easy to check status of actions

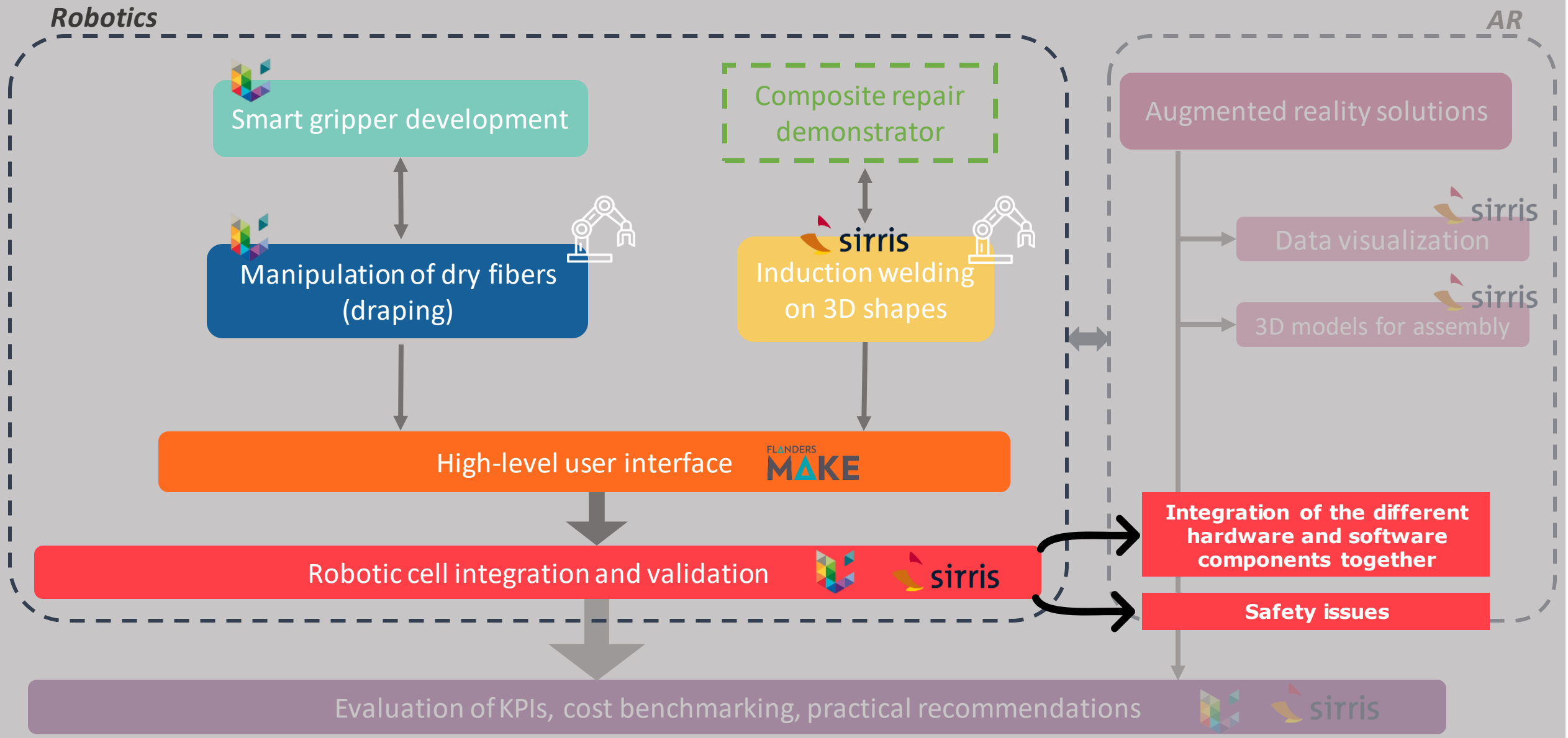
sirris
3D models for assembly

High-level user interface FLANDERS MAKE

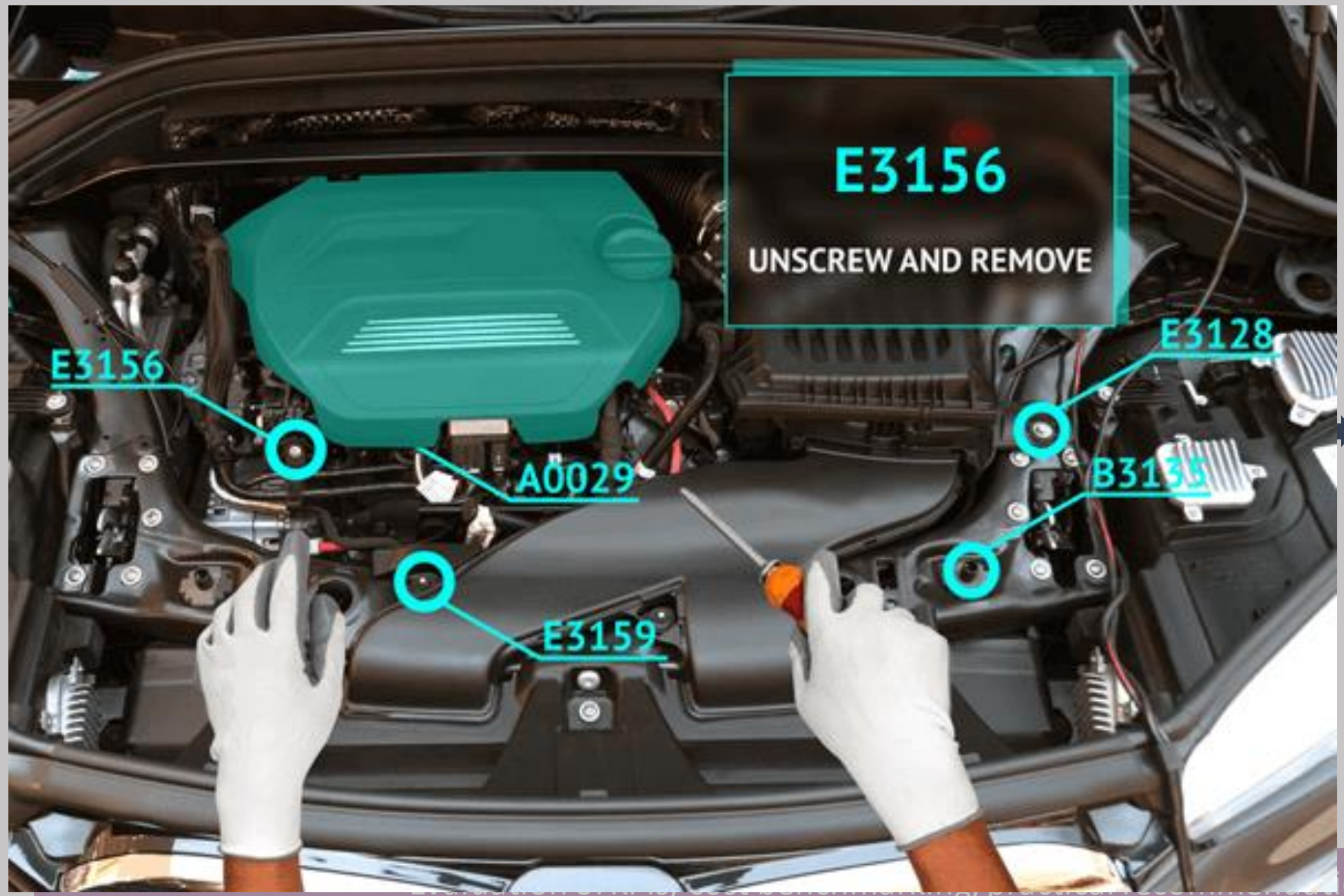
Robotic cell integration and validation

Evaluation of KPIs, cost benchmarking, practical recommendations sirris

General workplan



General workplan



AR

Augmented reality solutions

sirris

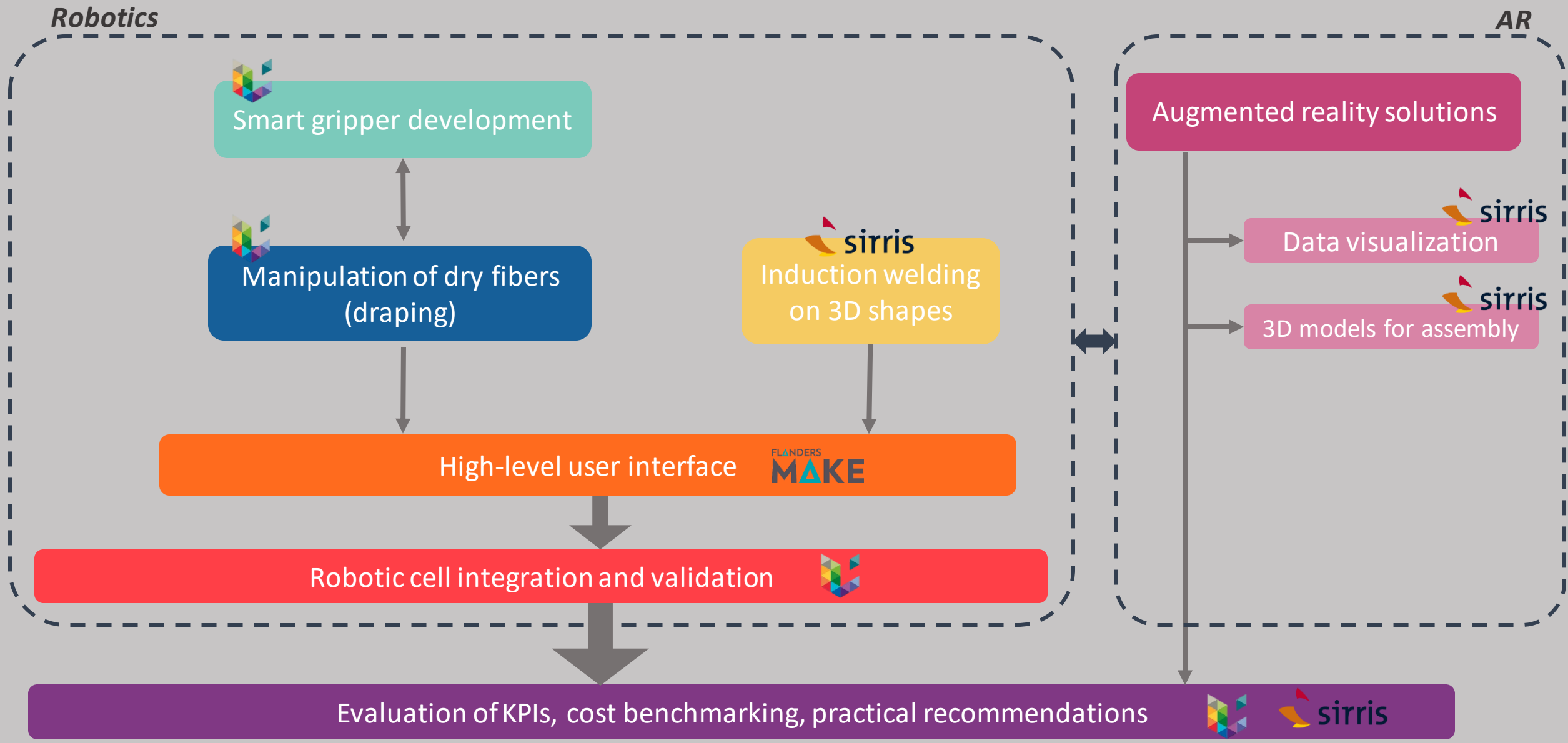
Data visualization

sirris

3D models for assembly

sirris

General workplan



Current status

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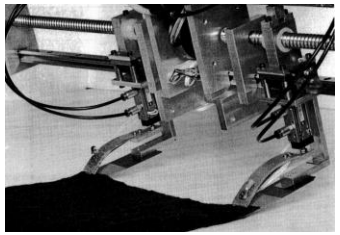
- Smart gripper development
  - T1.1 Choose appropriate gripping technology + tests
  - T1.2 Build the gripper, test pick & place
  - T1.3 Treatment of sensors signals
- Manipulation of dry fibers (draping)
- Induction welding on 3D shapes
- High-level user interface
- Robotic cell integration and validation
- Augmented reality solutions
- Evaluation of KPIs, practical recommendations

Mechanical



Vacuum

Adhesion

Needles

Freezing

Current status

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Smart gripper development

Manipulation of dry fibers (draping)

T2.0 Case study identification and resources collection (mold, …)

T2.1 Determine a grasping strategy (quality metric)

T2.2 Modelize dry fabric behavior

T2.3 AI/Opti to choose grasping points

T2.4 Control the gripper, generate trajectory

Induction welding on 3D shapes

High-level user interface

Robotic cell integration and validation

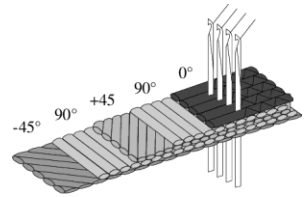
Augmented reality solutions

Evaluation of KPIs, practical recommendations

Test drapability and compatibility with grippers

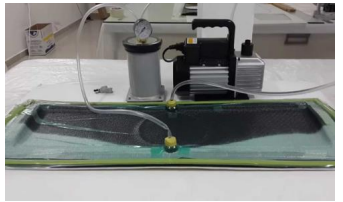
Carbon (twill 2x2, UD)

Basalt (twill, satin)



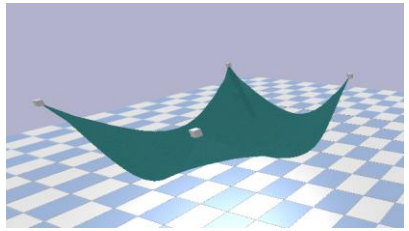
Non-crimp fabrics (NCF)

Manufacturing process



Vacuum infusion with epoxy at Centexbel

First simulations



Current status

Smart gripper development

Manipulation of dry fibers (draping)

Induction welding on 3D shapes

T3.1 Integration of an induction coil on robotic arm

T3.2: Robot programming and test on simple shapes

T3.3: Test on more complex geometries, curved pieces

T3.4: Production of demo pieces (repair demo)

High-level user interface

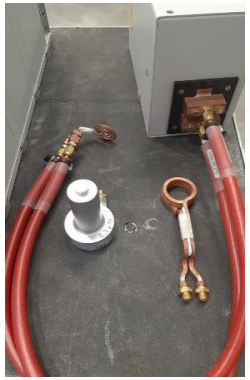
Robotic cell integration and validation

Augmented reality solutions

Evaluation of KPIs, practical recommendations

Induction welding trials on simple geometries

- Manual assembly for the moment
- Development of the process
- Definition of requirements of the parts to be welded



Current status

Smart gripper development

Manipulation of dry fibers (draping)

Induction welding on 3D shapes

High-level user interface

Robotic cell integration and validation

Augmented reality solutions

T6.1 : Definition of an assembly sequence

T6.2 : Integration of the manipulation in the AR system

T6.3 : Testings and improvements

T6.4 : Temperature vizualization in induction welding

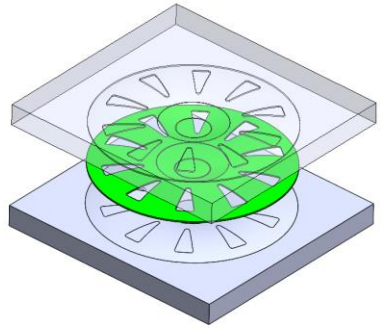
Evaluation of KPIs, practical recommendations

Definition of an assembly sequence

- Composite hubcap manufacturing

  ➔ Beginning of the design of the part

- Started integration in dedicated software to create the application



Thank you!

DEMO #5 project Leader

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Questions ?