Turning high-end composite manufacturing systems into Printers

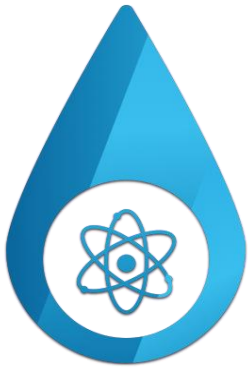
AZL Work Group – 9 October 2019

Airborne

Airborne group

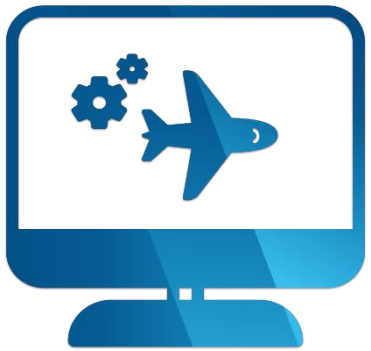
≈ 125 employees

Facilities in The Netherlands and the UK



20+ year legacy in design and manufacturing of Advanced Composites: Aerospace, Marine, Renewables, Industrial and Oil & Gas

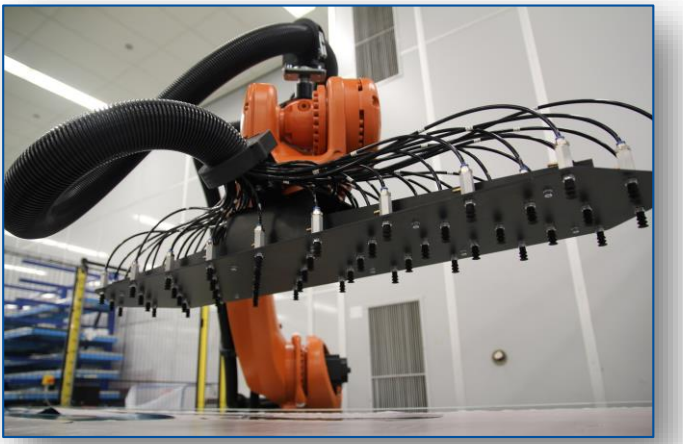
Supplying automated and digital manufacturing systems, to radically industrialise composite manufacturing

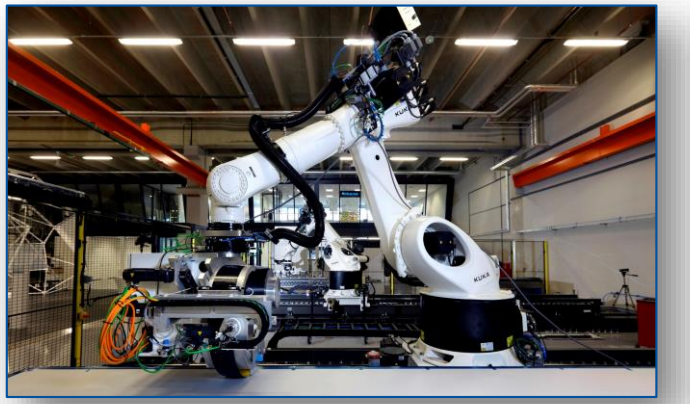


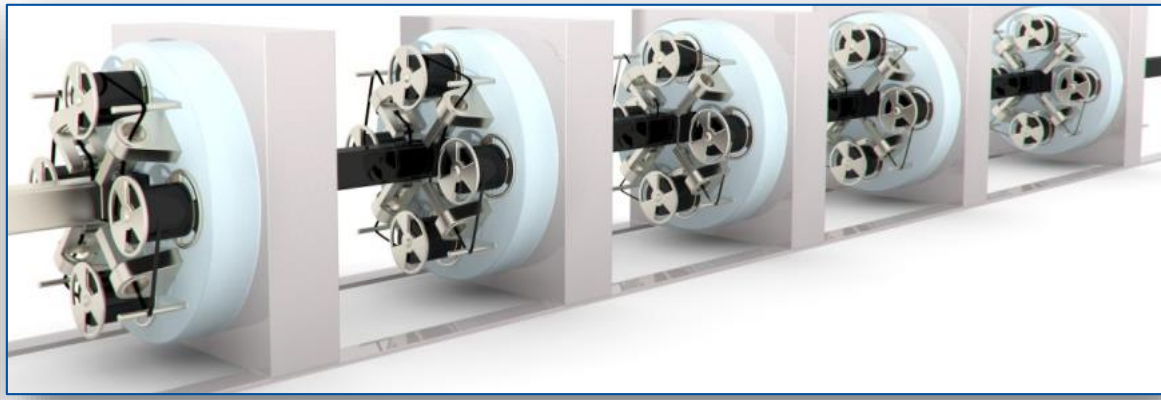
Vision: Digital, on-demand manufacturing platform

MGW 195000 KG
TARE 38000 KG
PAYLOAD 87000 KG

SEAFLEX







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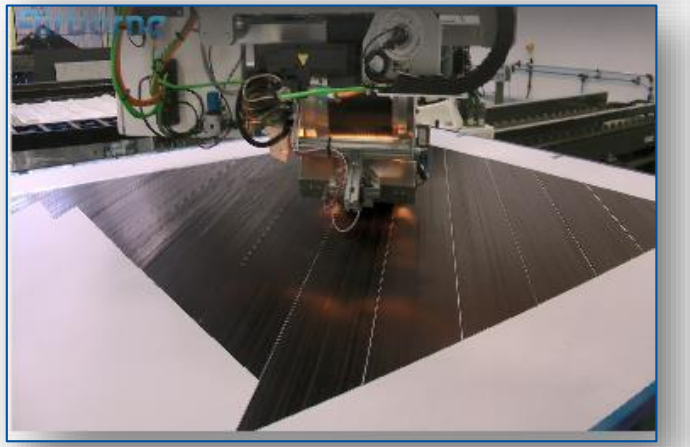
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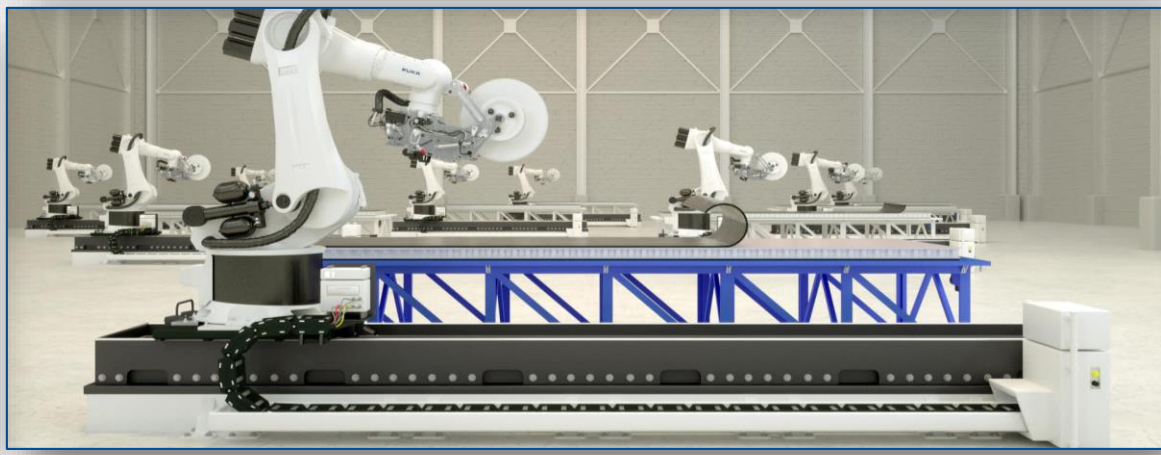

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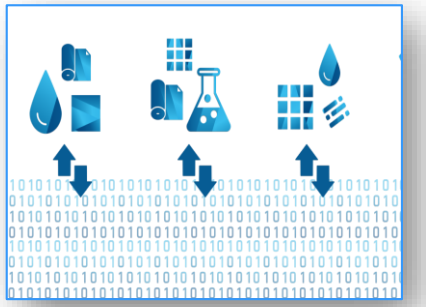
KUKA

Composite manufacturing know-how

Know-how of Composite Manufacturing

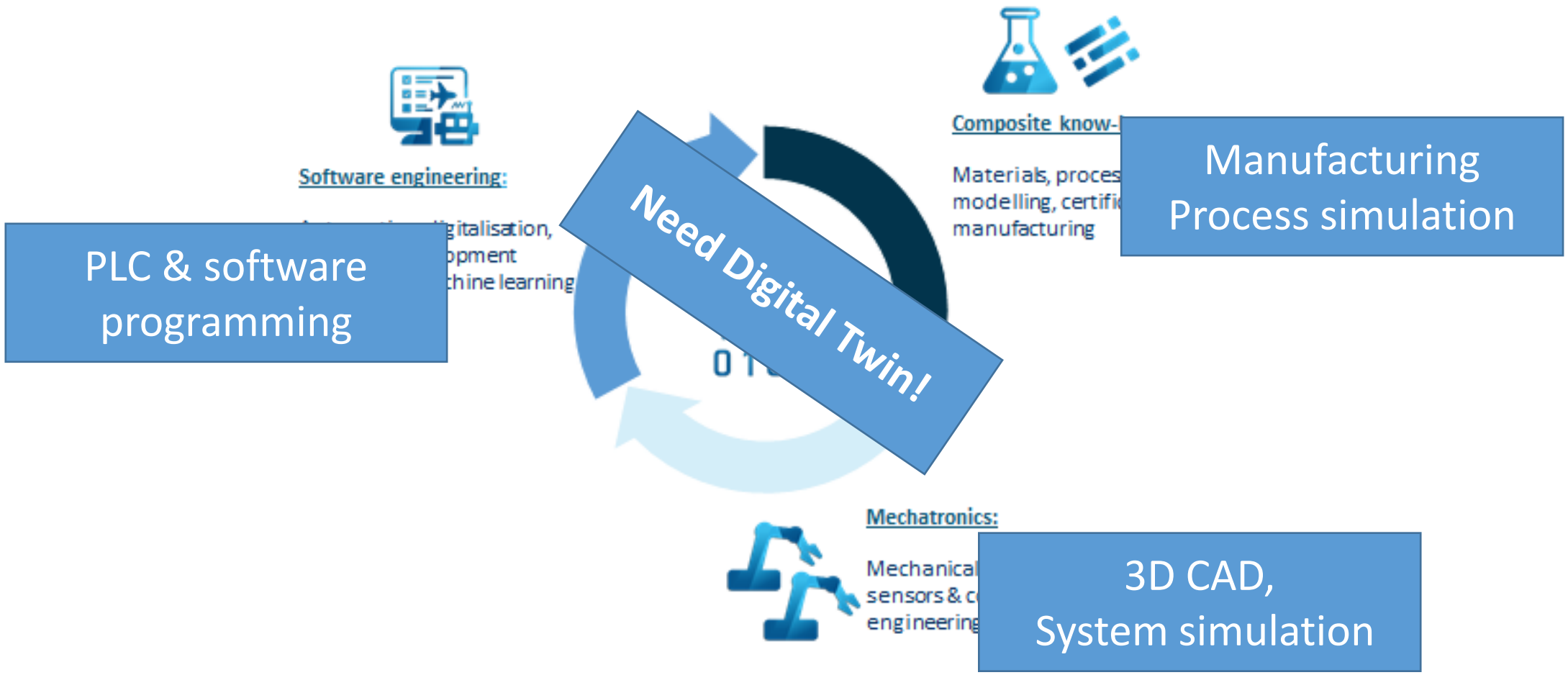
Part manufacturing

Automated *processes*



Digital manufacturing

Unique combination of skills



PLC & software programming

Manufacturing
Process simulation

3D CAD,
System simulation

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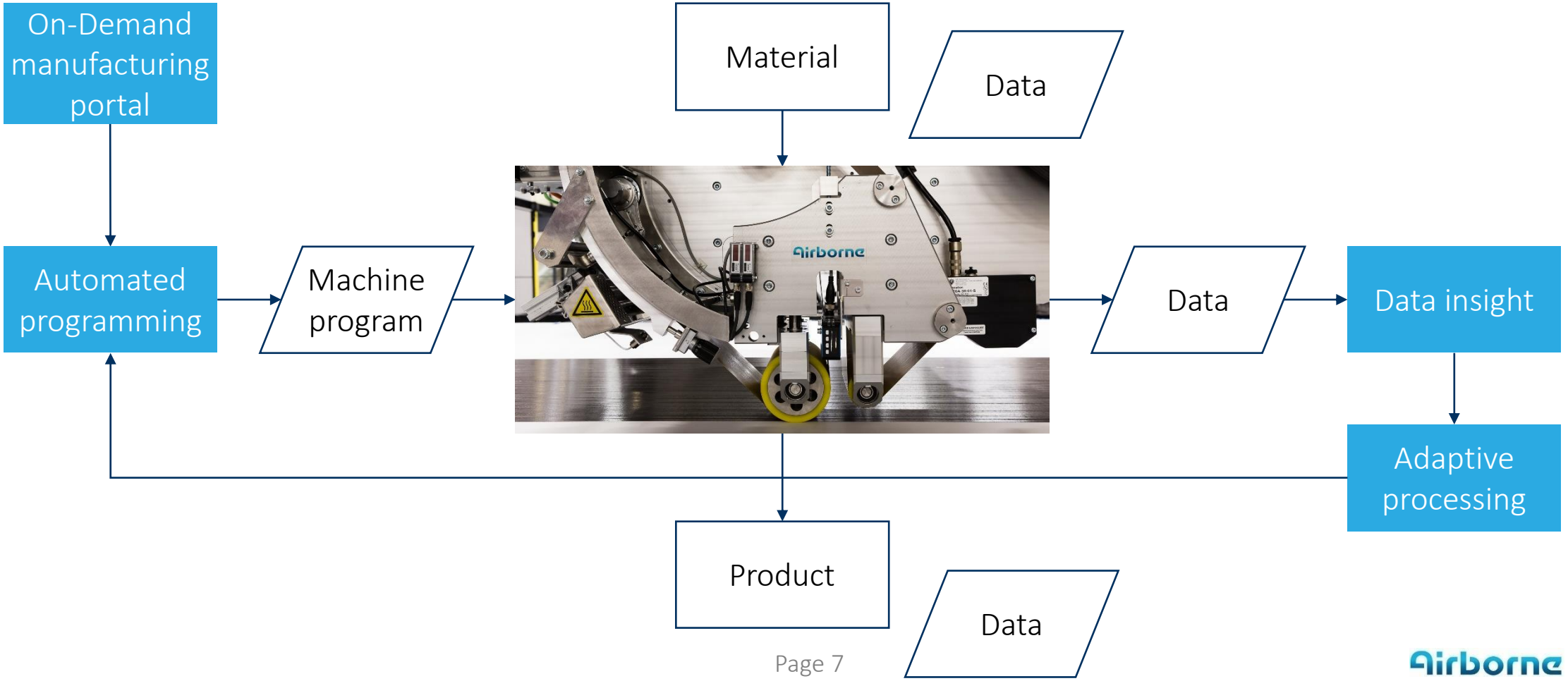
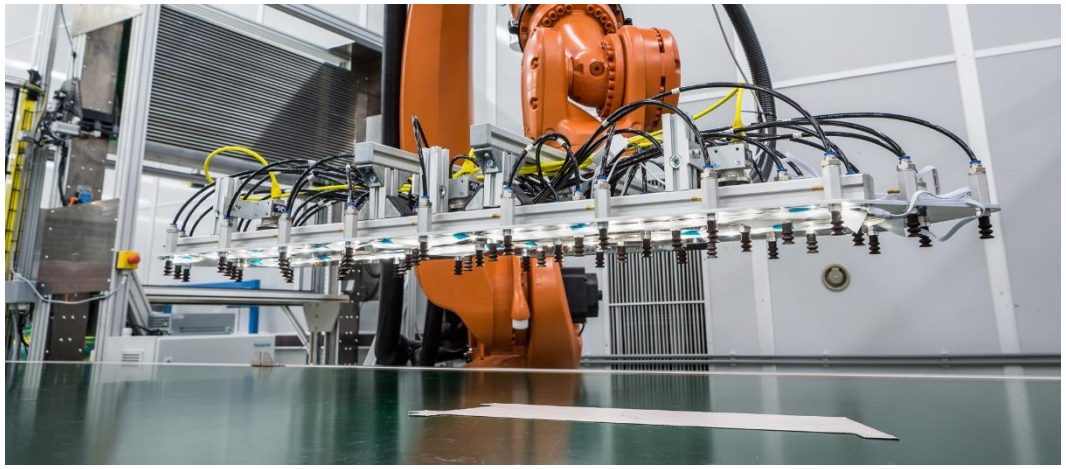
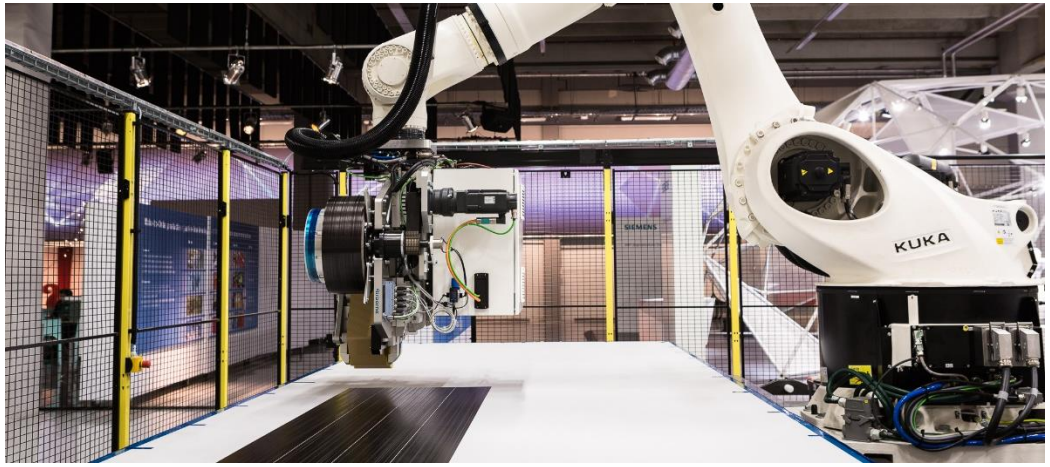
Airborne's digital framework



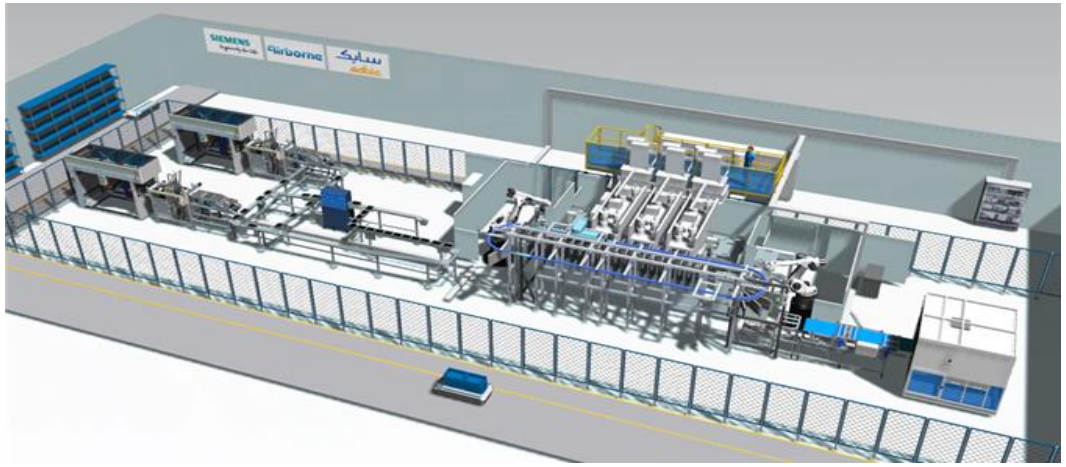
Automated Honeycomb Potting



Automated Ply Kitting



Automated Lamination



High Volume Thermoplastic

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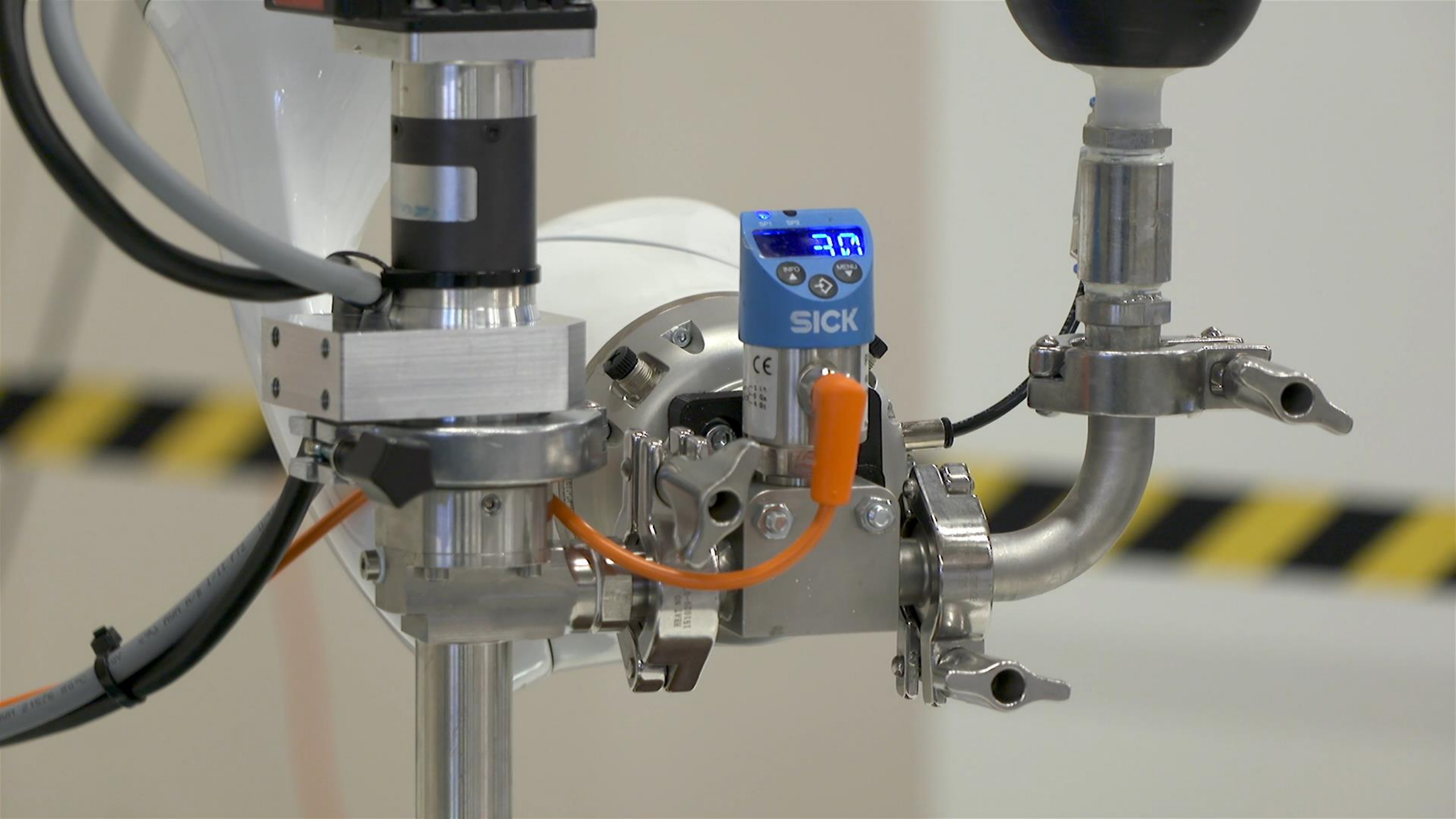
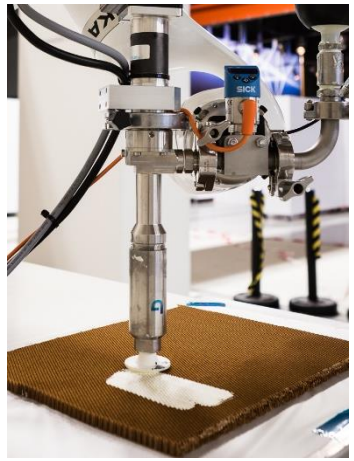

SICK

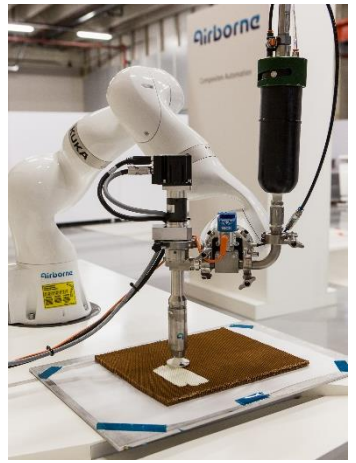
Automated Honeycomb Potting

https://vimeo.com/337519192/1e24ac890f

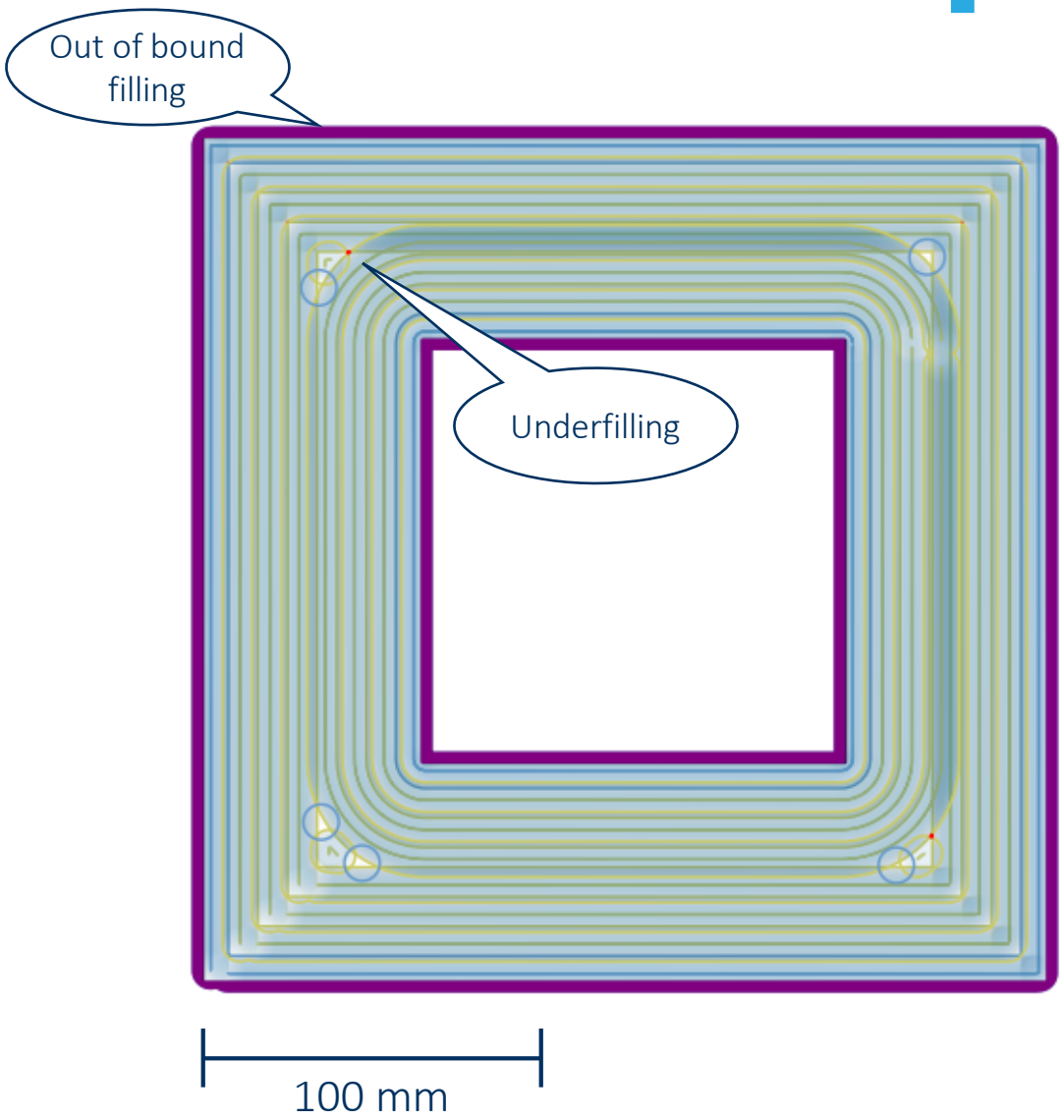
https://www.youtube.com/watch?v=0h0hDeo-p9Y

- High material efficiency
- Repeatable process
- Easy to setup, no programming needed
- Avoids toxic exposure





Automated programming



- Potting path determined using an advanced optimisation algorithm
- Potting path optimized to minimise material use and optimise potting speed
- Dispensing algorithm automatically adjusted as a function of the path

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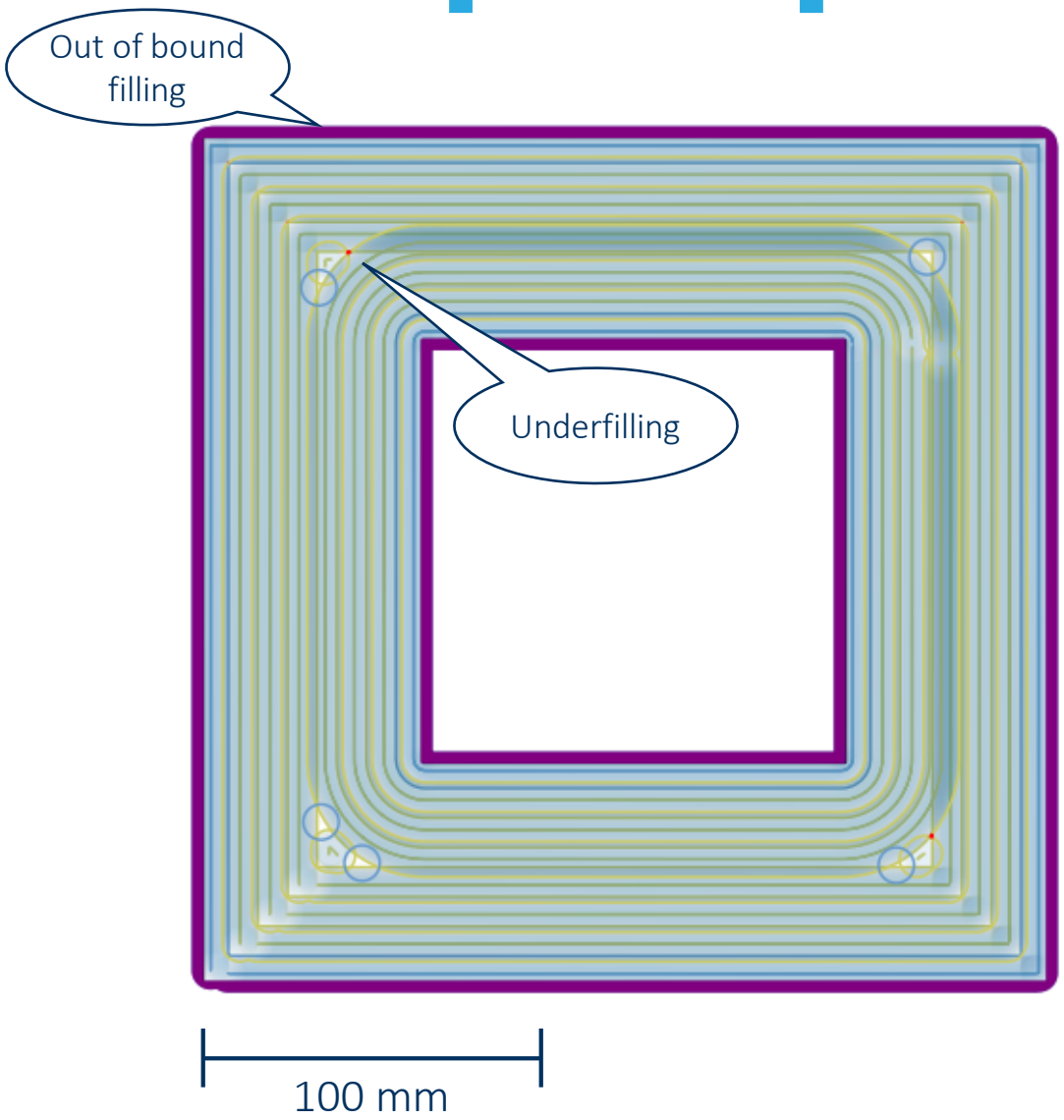
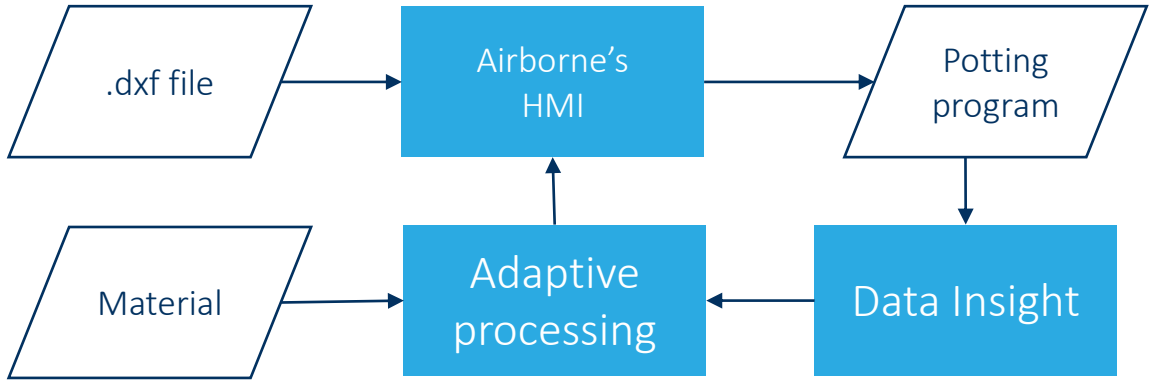
Adaptive processing

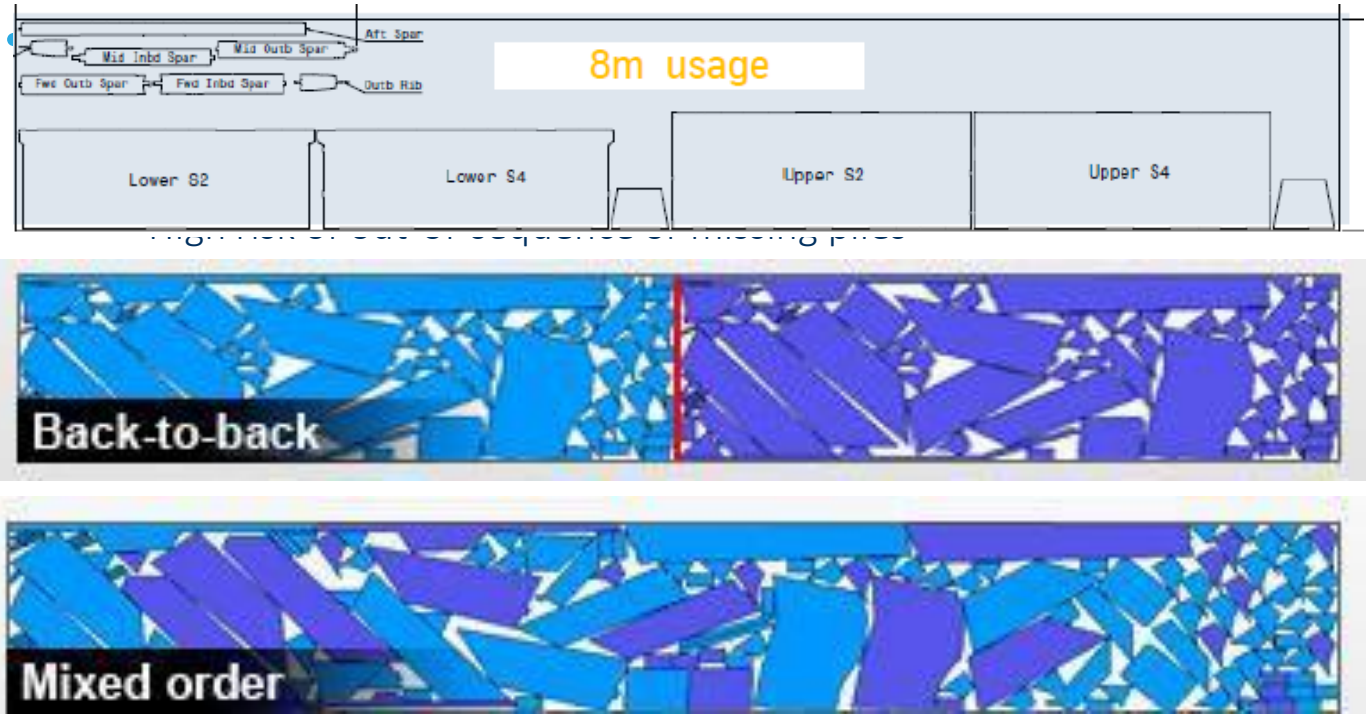




- Developing material model, to be able to predict output quality and filling rate
  - Highly viscous, changing over time, thixothropic, glass spheres

Cutting and Kitting of composite plies

Development in industry



Consequence of this approach

- Very high amount of random plies for operator to sort
- Large (expensive) cleanroom area for offloading and sorting tables
- High risk of out-of-sequence or missing plies

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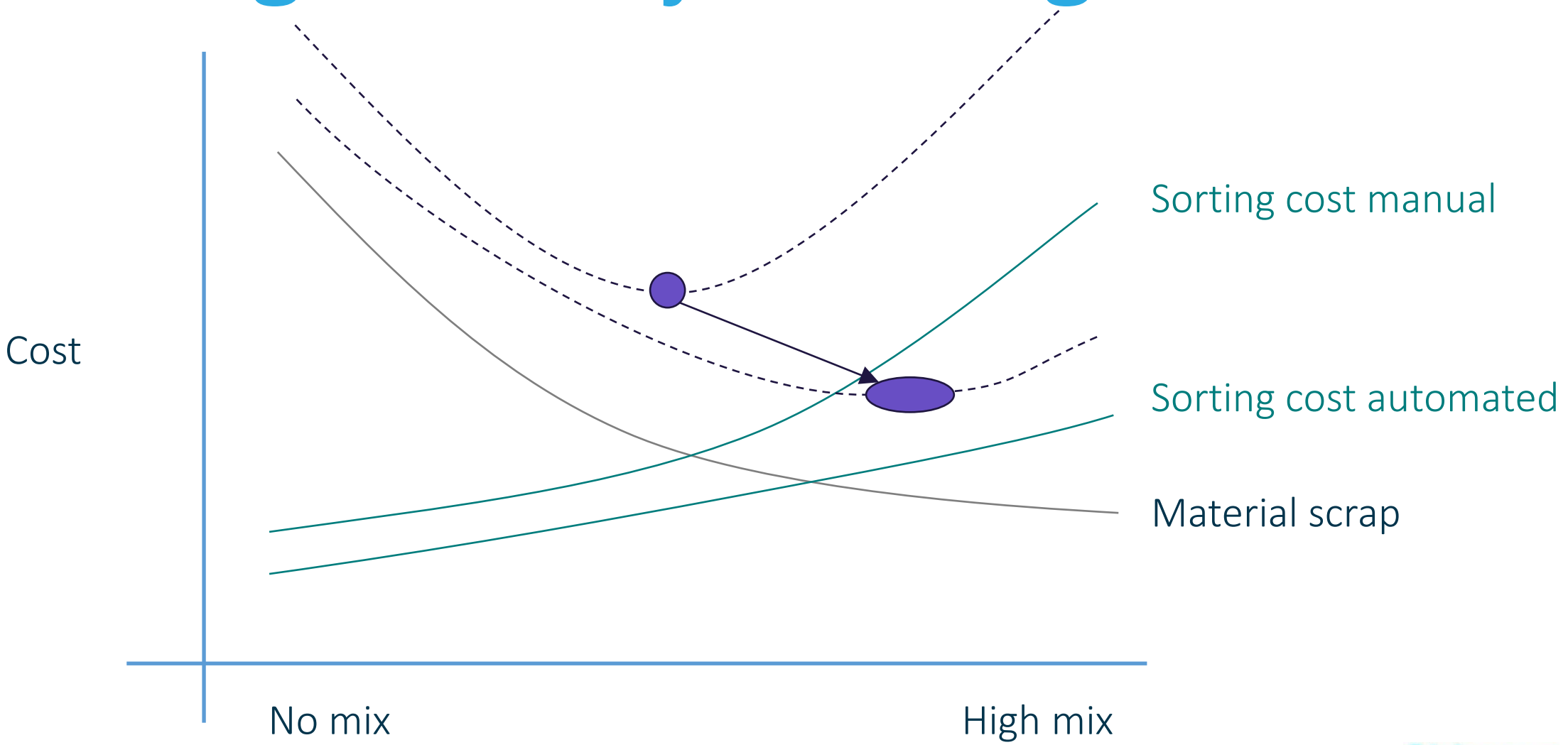
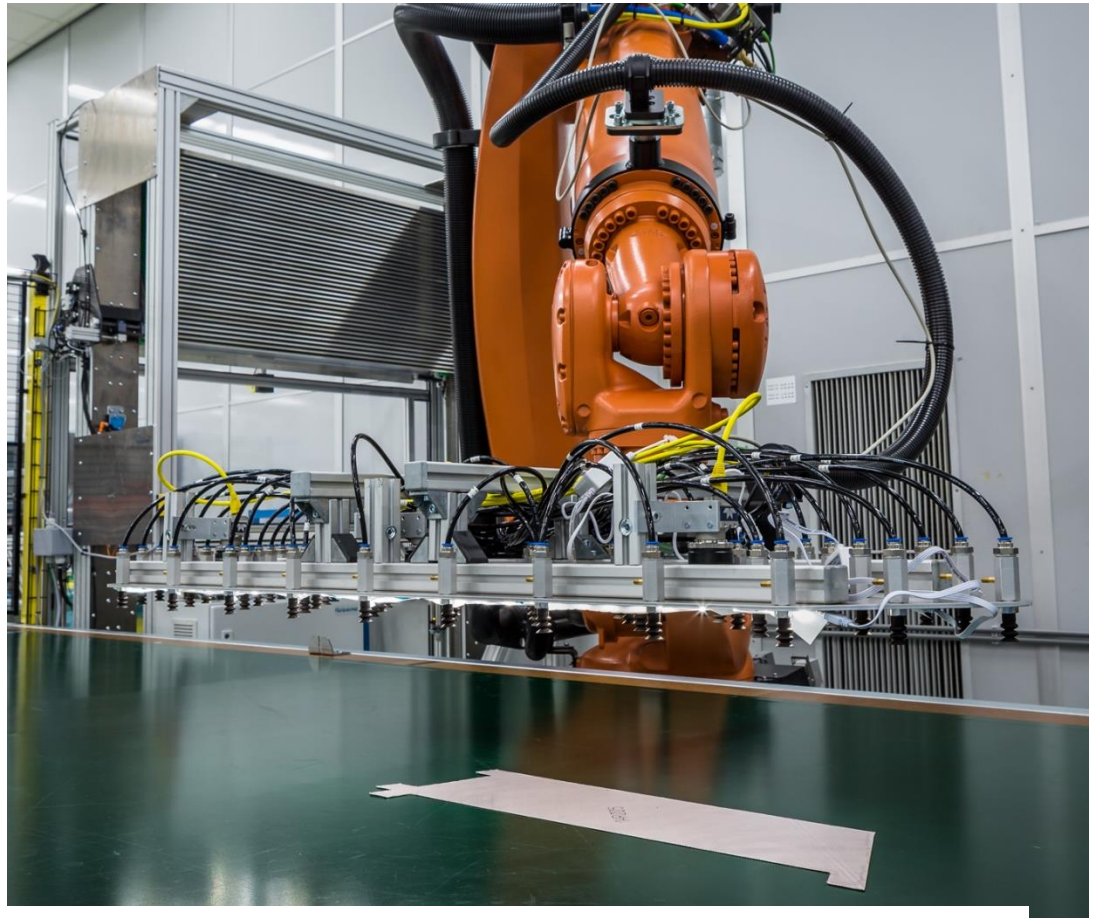
Nesting efficiency vs sorting



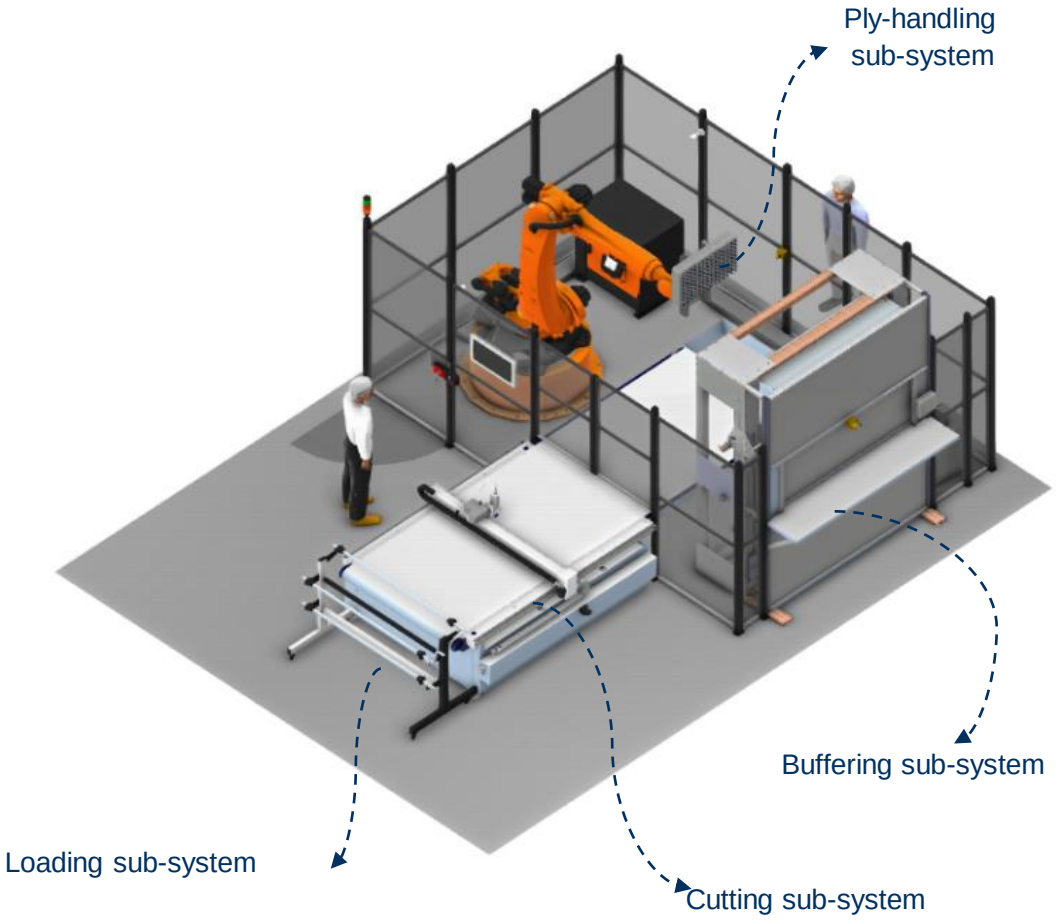
Automated Ply Kitting

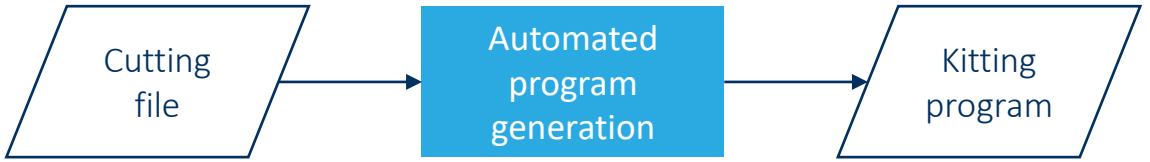


- Increased material efficiency
- Increased ply cutter capacity
- No kitting errors
- Full quality traceability
- Increased operational flexibilty

https://www.youtube.com/watch?v=9KcElH_yUE8

Automated programming





- Cutting file interpreted by Airborne's software
- Material specific process parameters retrieved from database
- Robot code and end effector control automatically determined, on-the-fly

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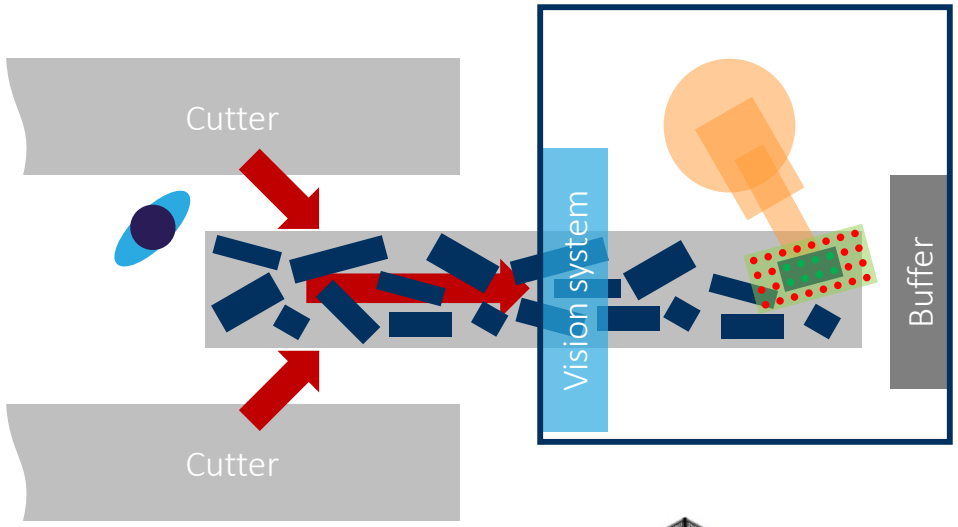
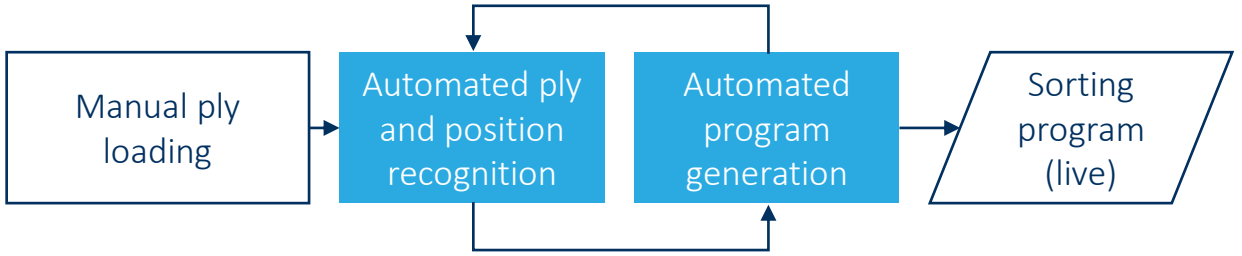
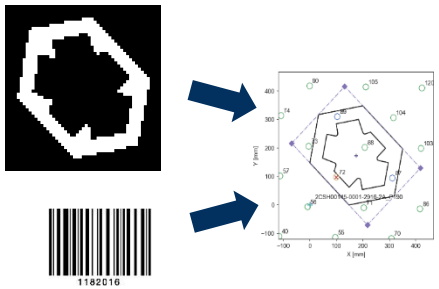
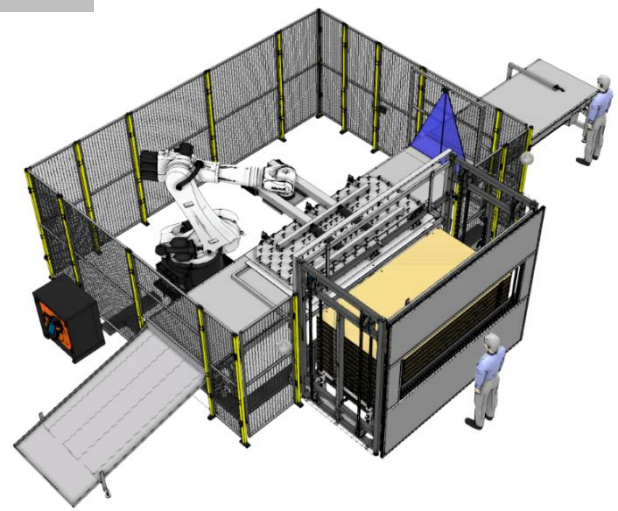
Adaptive processing





- Plies manually loaded to conveyor belt
- Plies and their position identified using barcode and vision system
- Robot code (including individual suction cup activation) automatically determined
- Provides opportunity for Adaptive nesting and cutting





Unlocking the digital factory

ERP/MES

Digital manufacturing backbone

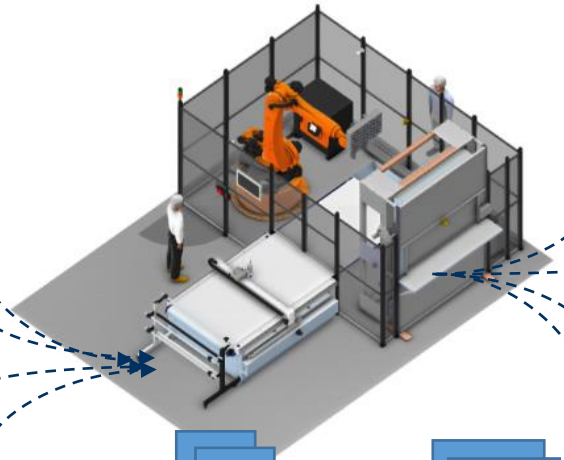
Warehouse | Nesting | Cutting & Kitting | Laminating | Parts stock | Assembly

Material roll #a

Material roll #b

Material roll #c

Material roll #n



Plies

Plies

Plies

Plies

Kits

Kits

Laminating cell #1

Laminating cell #2

Laminating cell #3

Laminating cell #n

Stock

Stock

Stock

Stock

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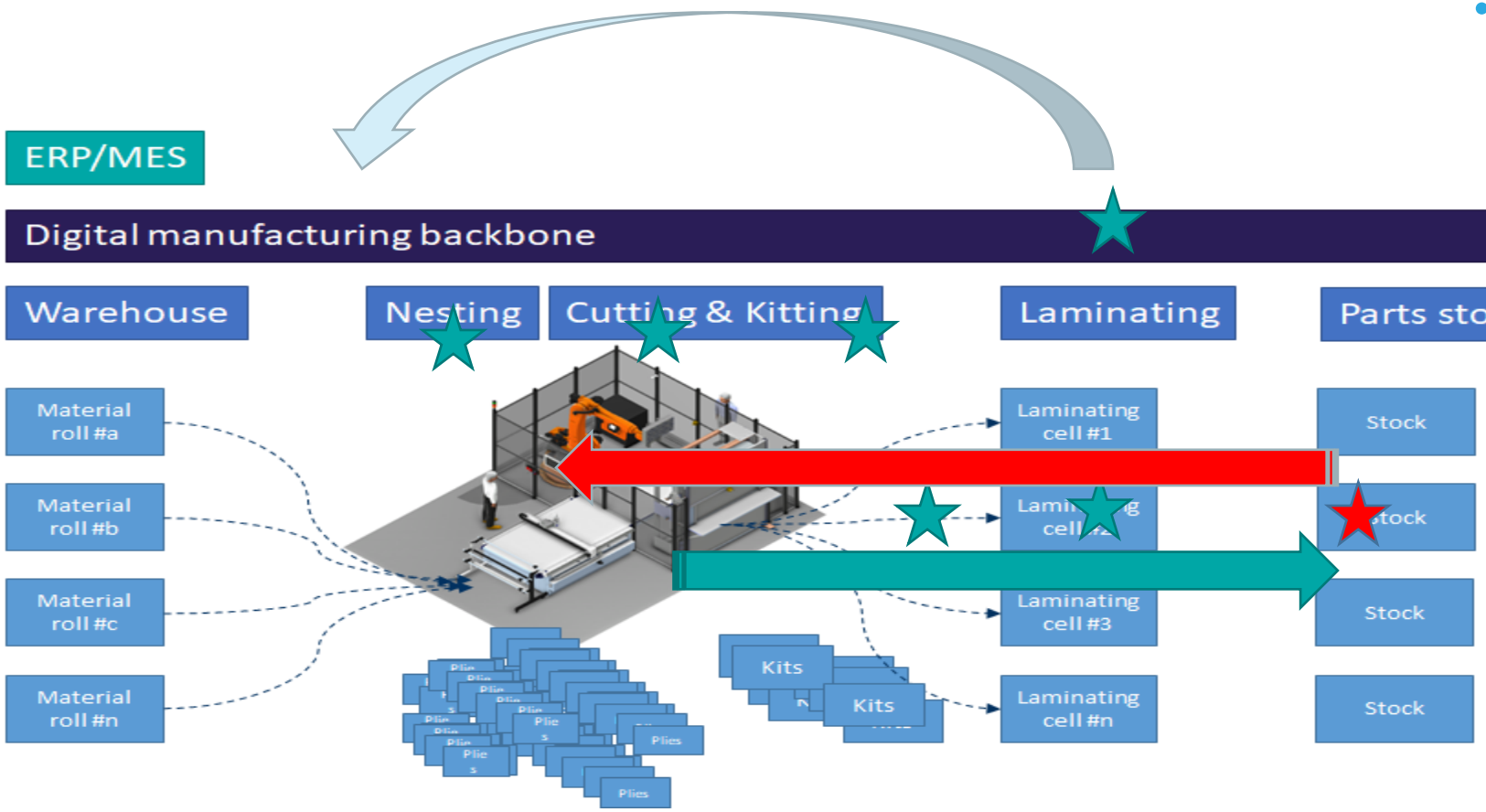
Unlocking the digital factory

- Dynamic, real-time, nesting
  - Cutting on demand
  - Extremely complex nests



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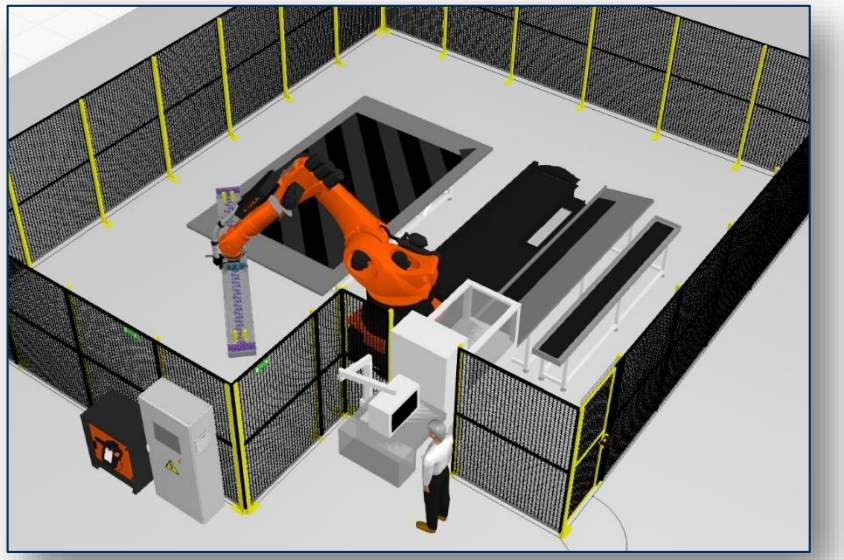
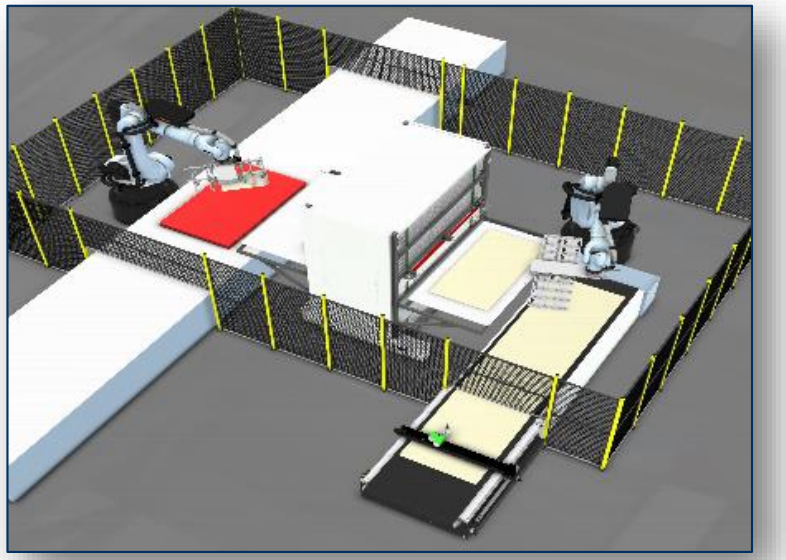
Automated preforming: TP or dry fibre

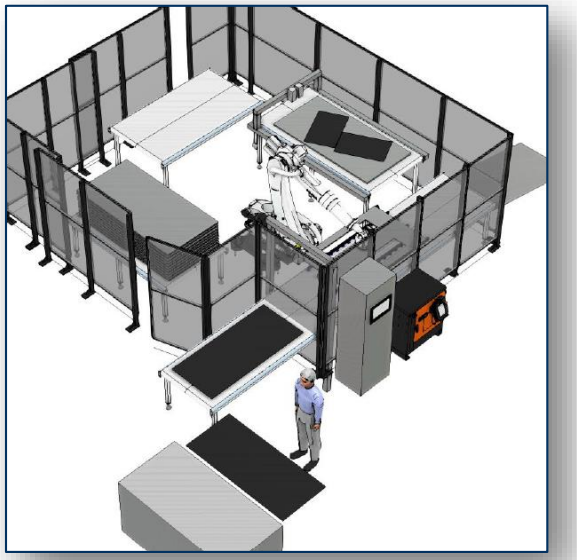
Automated preforming cell for thermoplastic blanks

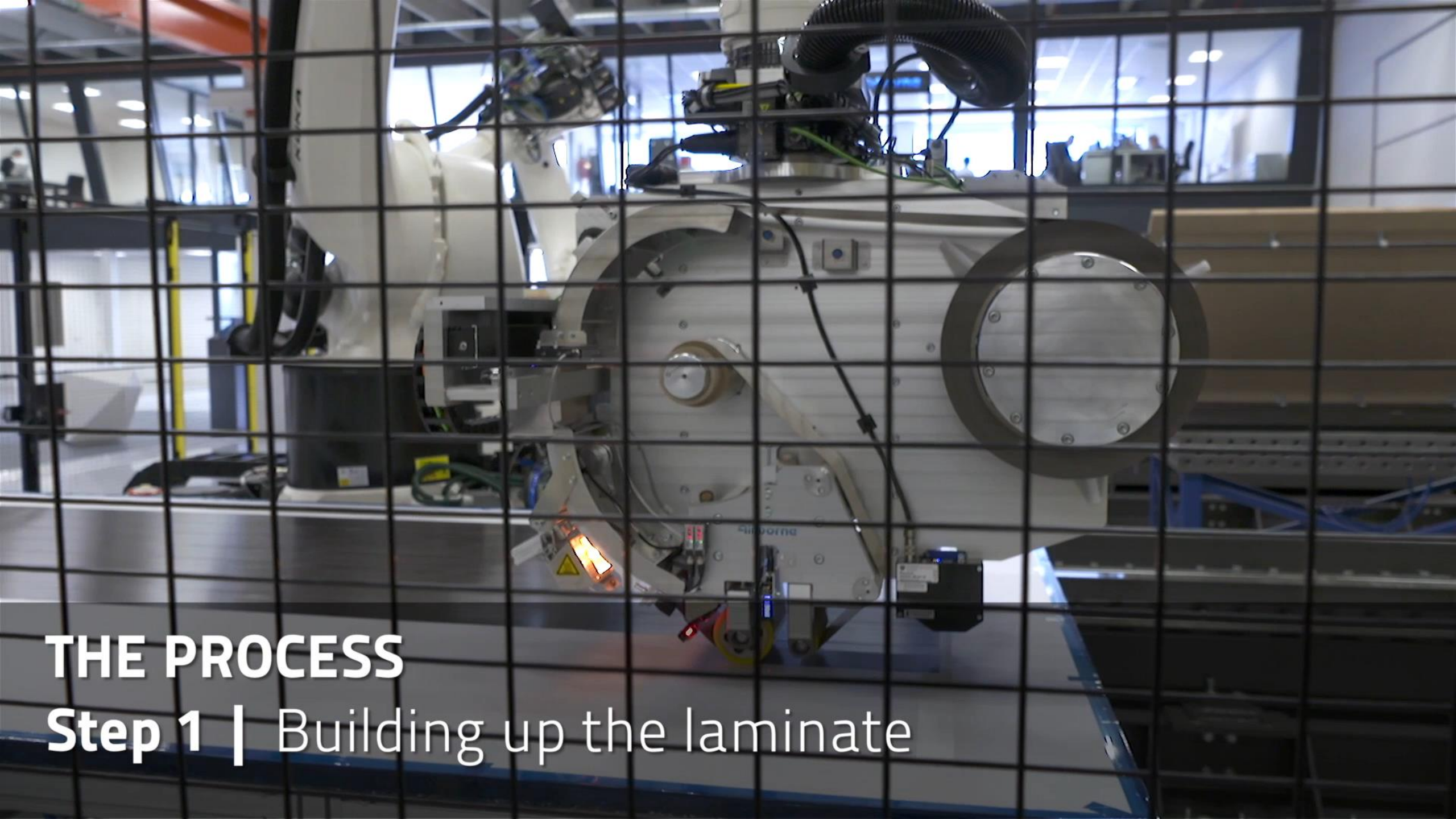


Automated preforming cell with integrated kitting system



Automated preforming for dry fibre laminates

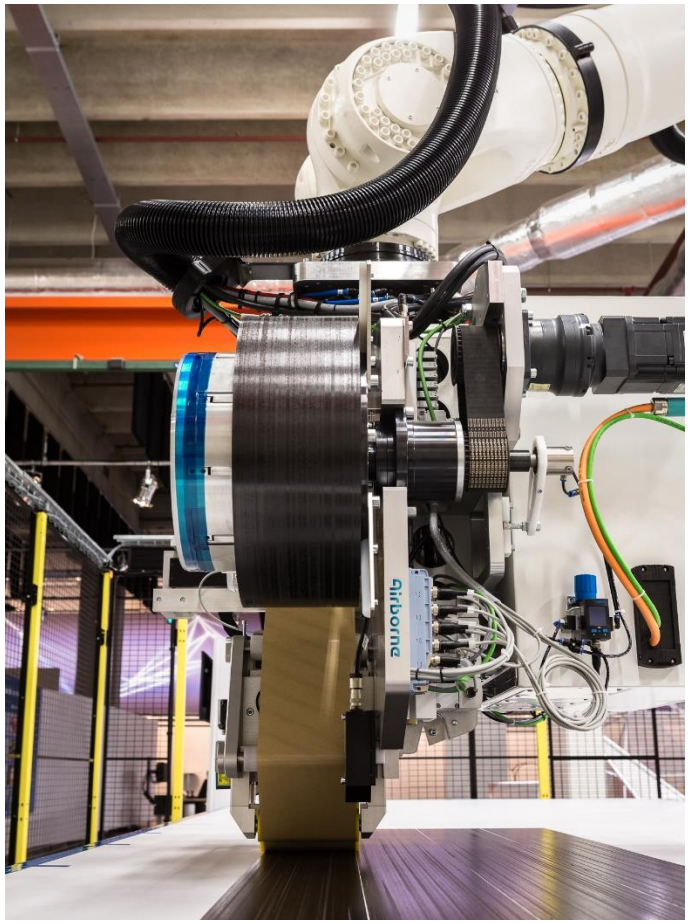


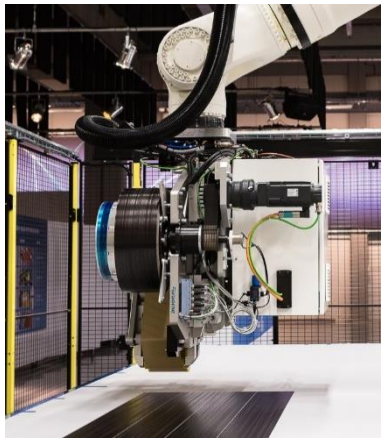


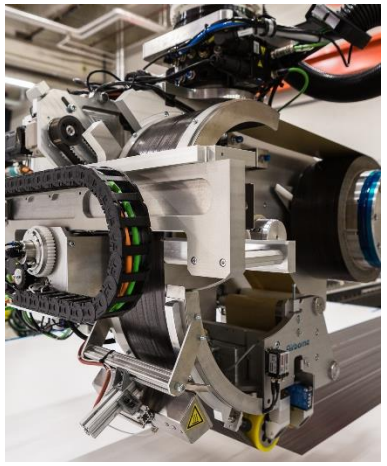
THE PROCESS

Step 1 | Building up the laminate

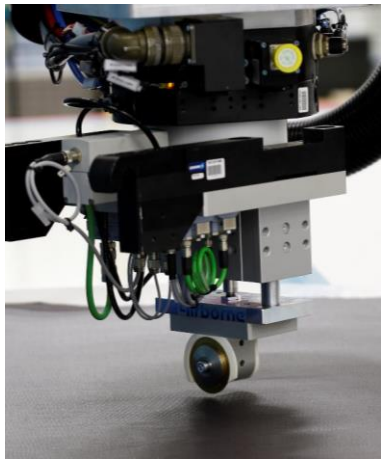
Automated Lamination







- 3 functions in 1 system
- High material throughput
- Tailored preforms
- Can offload to next system



https://www.youtube.com/watch?v=hDLrCw_WXBM

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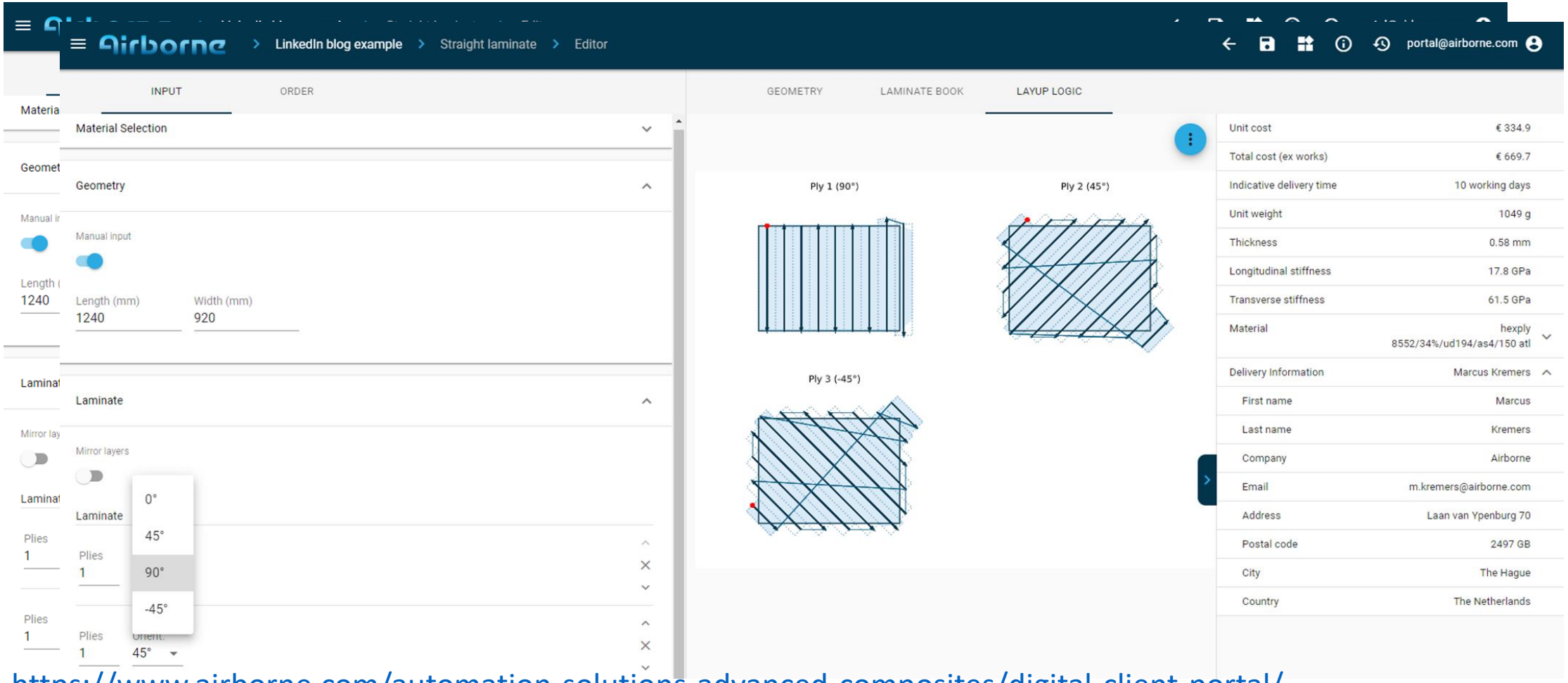
INTRODUCING

AIRBORNE CLIENT PORTAL

https://www.youtube.com/watch?time_continue=2&v=1iUPn8tZKFg

On-demand manufacturing portal



https://www.airborne.com/automation-solutions-advanced-composites/digital-client-portal/
https://www.youtube.com/watch?time_continue=2&v=1fUPn8tZKFg

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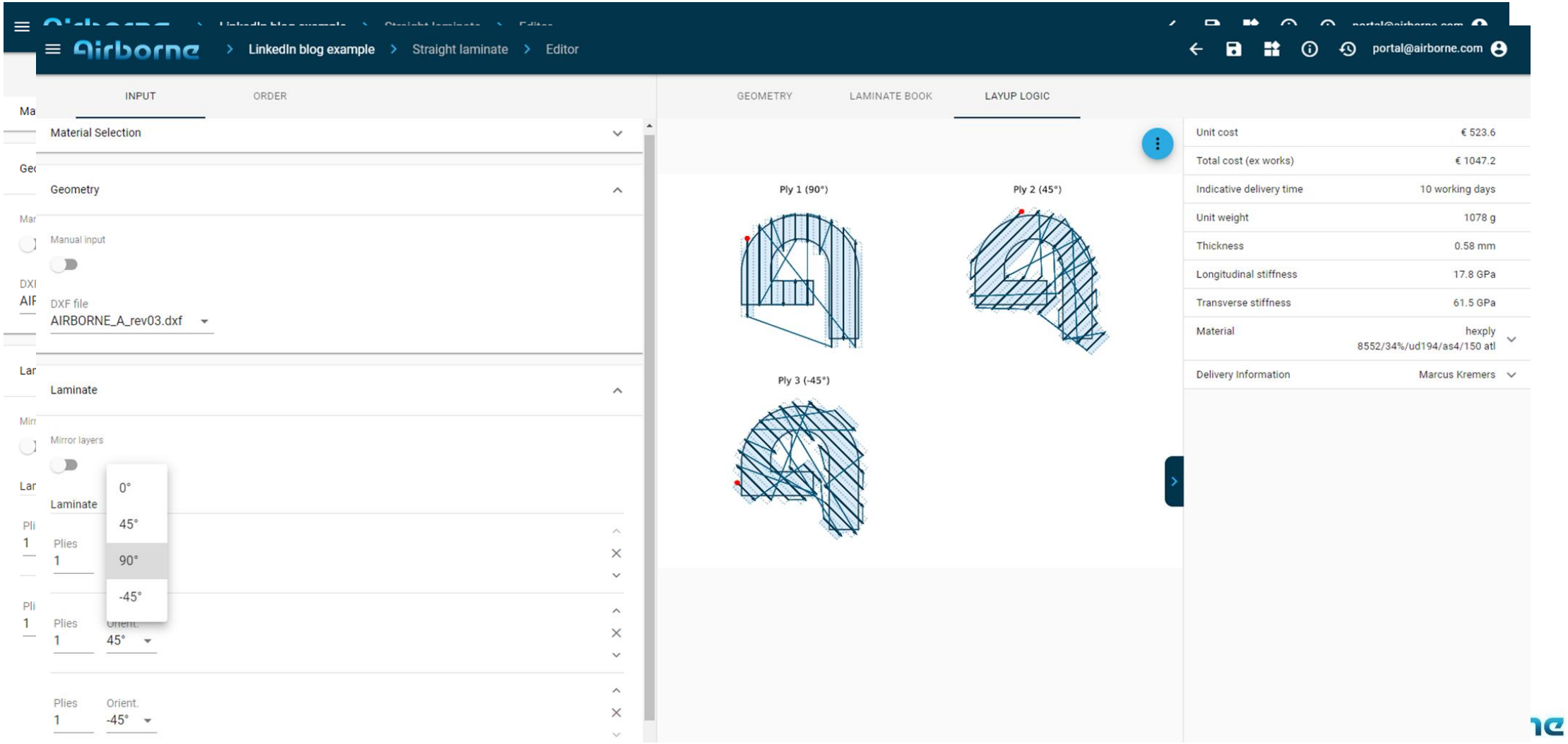
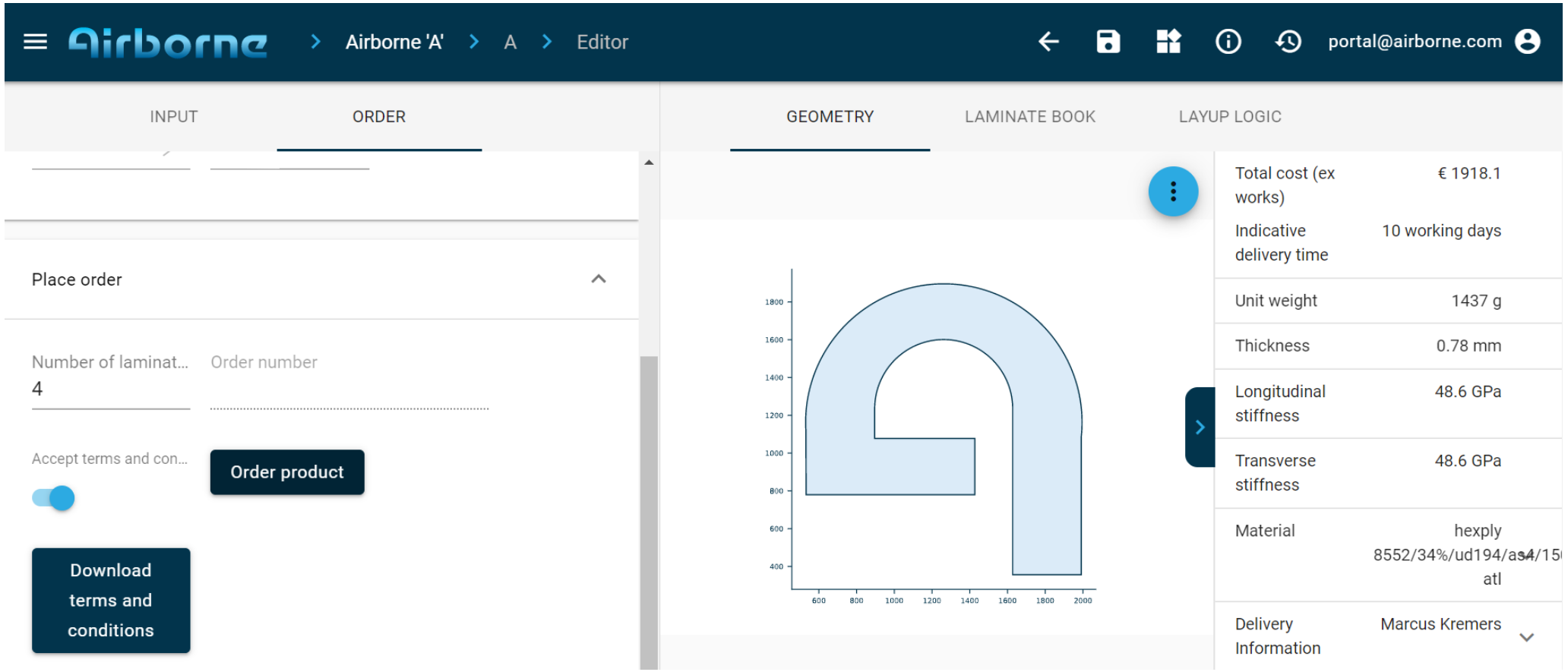
On-demand manufacturing portal



On-demand manufacturing portal



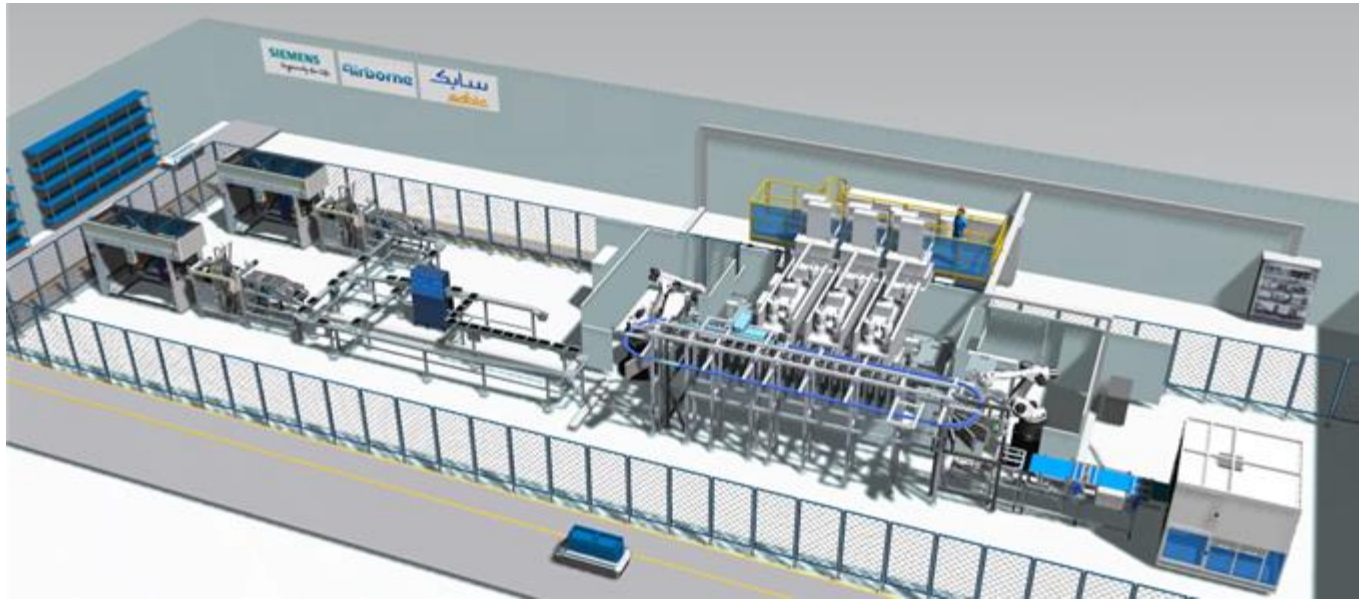
https://www.airborne.com/automation-solutions-advanced-composites/digital-client-portal/

SIEMENS
Ingenuity for life

Airborne

سابك
sabic

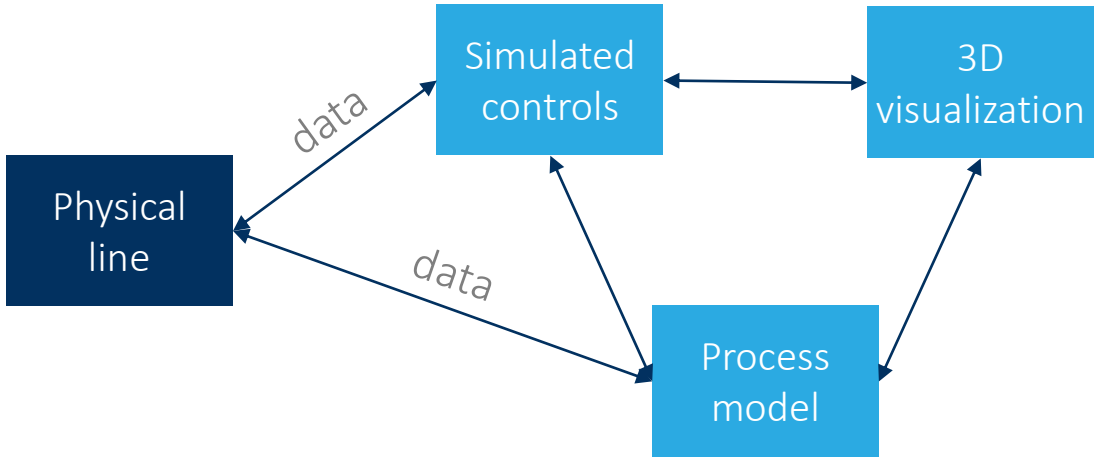
High Volume Thermoplastic



- Radical new concept for consolidating laminates
- 1.5 million parts / year, very low scrap rates
- End-to-end automation, thermoplastic, digital manufacturing
- Full quality inspection of the material and the product

Data Insights

- Challenge
  - Full inspection of incoming tape
  - Full inspection of outgoing product
  - 500+ sensors in the line
  - 15 million plies / year
- Data Warehouse
  - 200 sensors connected
  - Data points + images
  - Ready for cloud-based data analytics



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