BW Innovation Event 2025

Additive Manufacturing @ BW

Adding Layers of Flexibility to Design, Manufacturing, & Sourcing

Additivemanufacturing@barry-wehmiller.com

Better by Design

Session Agenda

BW ADDITIVE MANUFACTURING

- Updates – Making the complex simple
- Tools & Support to simplifying and drive adoption
- Additive Manufacturing's Impact @ BW
  - Enabling Quick-Turnaround in Converting
  - SpeedLinerX Product Development at Papersystems
  - High Value Applications at BWFS
- Simplifying Adoption with relevant examples

Quick Updates

- New Team Members supporting BW ADDITIVE MANUFACTURING
  - Elisa Jara in Stuttgart
  - L.J. Mott in Clearwater
- Progressing with our Strategic Vision
  - ***Two Global Additive Manufacturing Centers (AMC's) now open***
  - AMC-Stuttgart & AMC-Clearwater
- Support Available to help with implementation
  - Hands-on Training, Workshops, Site Visits, and more
- Printing production parts across the enterprise
  - Get started now to save time & cost, simplify sourcing, and enhance designs!

WHY use the AMC's?

Internal AMC utilization is vital to our success in AM

- Provides expertise & experience
- Standards – Quality – Reduced Variability
- Industrial Capabilities + Capacity (scale)

Why use the AMC now?

- **High utilization = lowest possible cost**
- Consistent material, process, and design standards
- Centers in both EMEA and NA – enables consistent global production

About more than just cost savings → provides responsive manufacturing and ensures stable / resilient supply

HOW to implement AM?

Knowledge Building (Training)

Hands-on Experience (Prototyping)

Production & Support @ AMC's

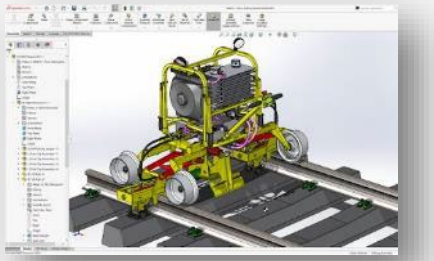
HOW? → Training & Support Options

Virtual or In-Person Training

Walk the Floor Visits

Hands-On Workshops

Design Reviews



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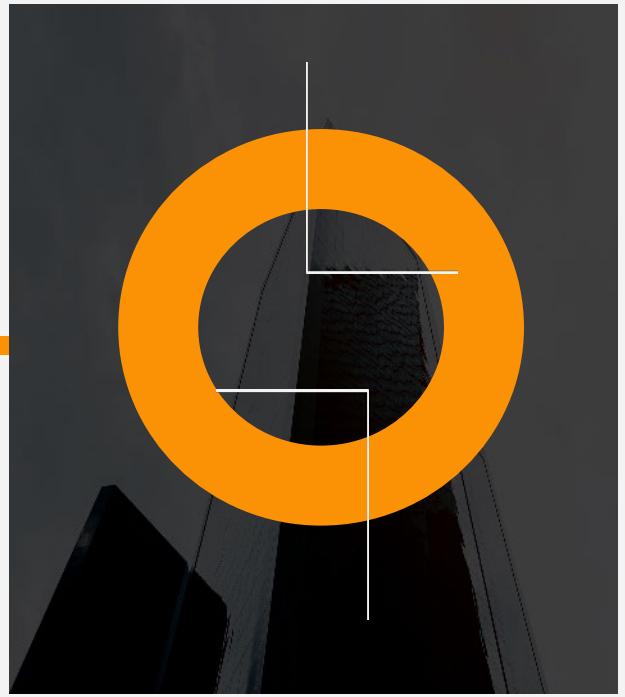
Simplifying Adoption

- Why? → Benefits
- Where? → Examples
- How? → Tools & Support

Where & Why – AM Across BW



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WHERE, WHEN, WHY to use AM?

Real world BW examples illustrating Applications, Processes, and Value

On-site printers

Parker Will
Hygiene Engineering Excellence Leader
BWC - GB

John Bessey
Engineer

BWC - GB

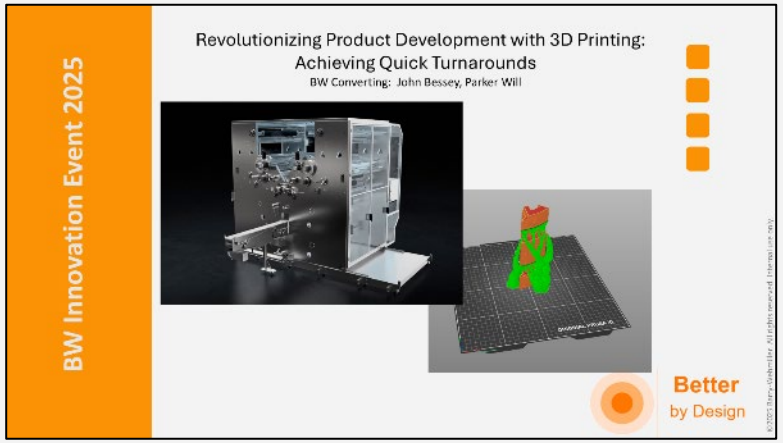
Andreas Schilling
Mechanical Chief Engineer

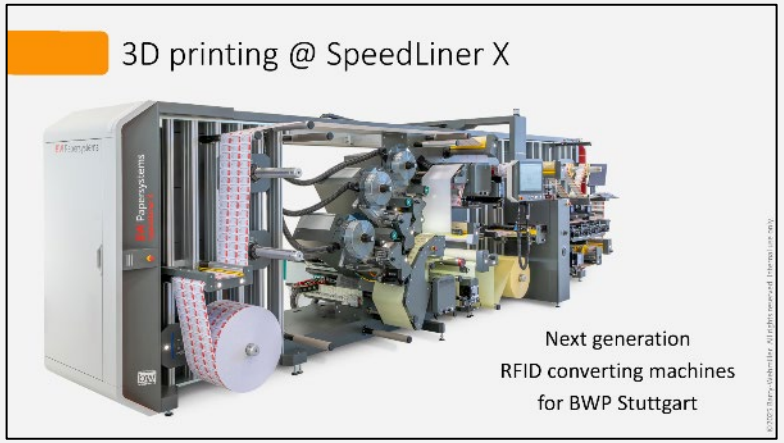
BWP – STU

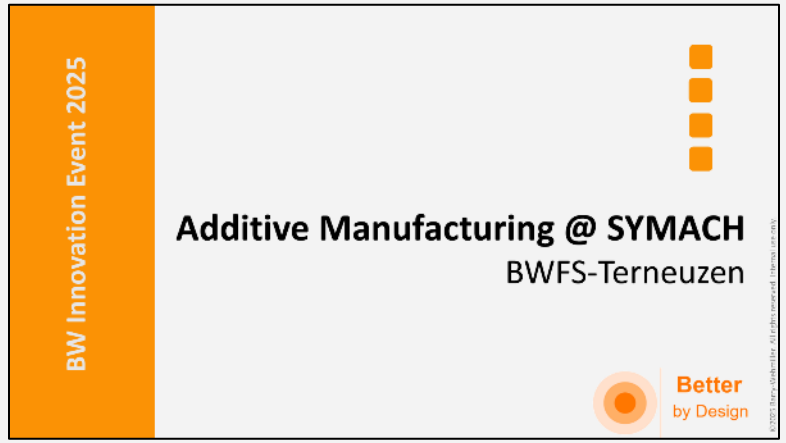
Christian Berger
3D Printing Engineer

BWP - STU

Peter Klaassen
Mechanical Engineering Leader
BWFS - TER



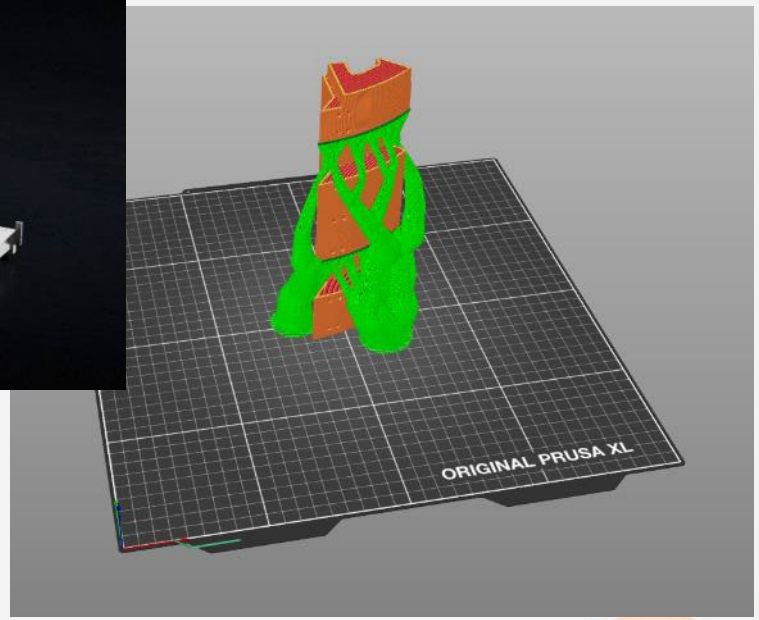




BW Innovation Event 2025

Revolutionizing Product Development with 3D Printing: Achieving Quick Turnarounds

BW Converting: John Bessey, Parker Will



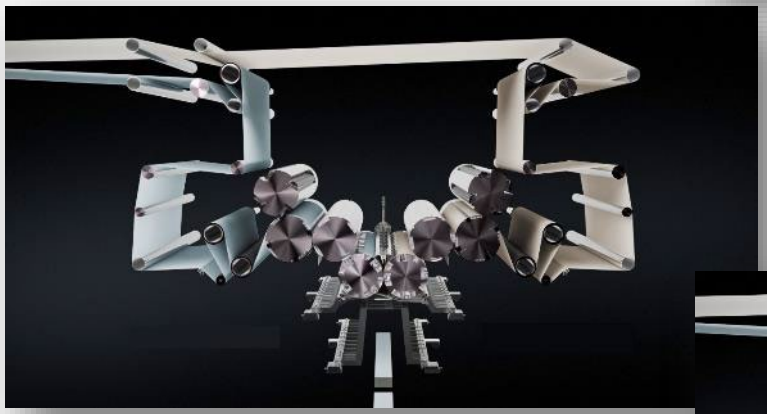
Better by Design

Introduction

Vertis Rotary Interfolder

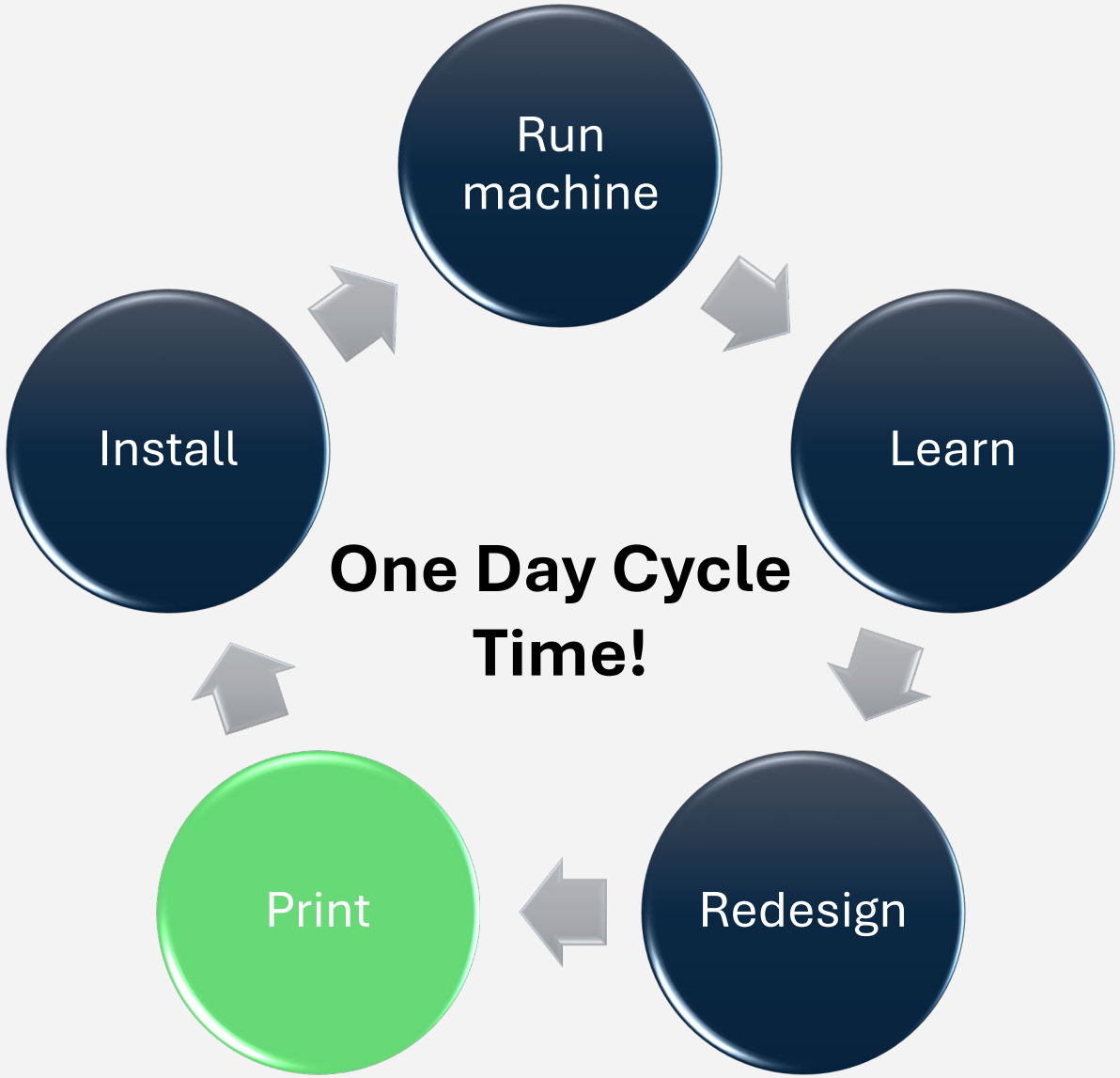
- Produce tear-resistant wet wipes from biodegradable materials

- Multiple unknowns requiring innovative solutions and rapid iterations
  - Vacuum system
  - Prefold rolls
  - Knife rolls
  - Stacking and separating
  - Gripping and tucking



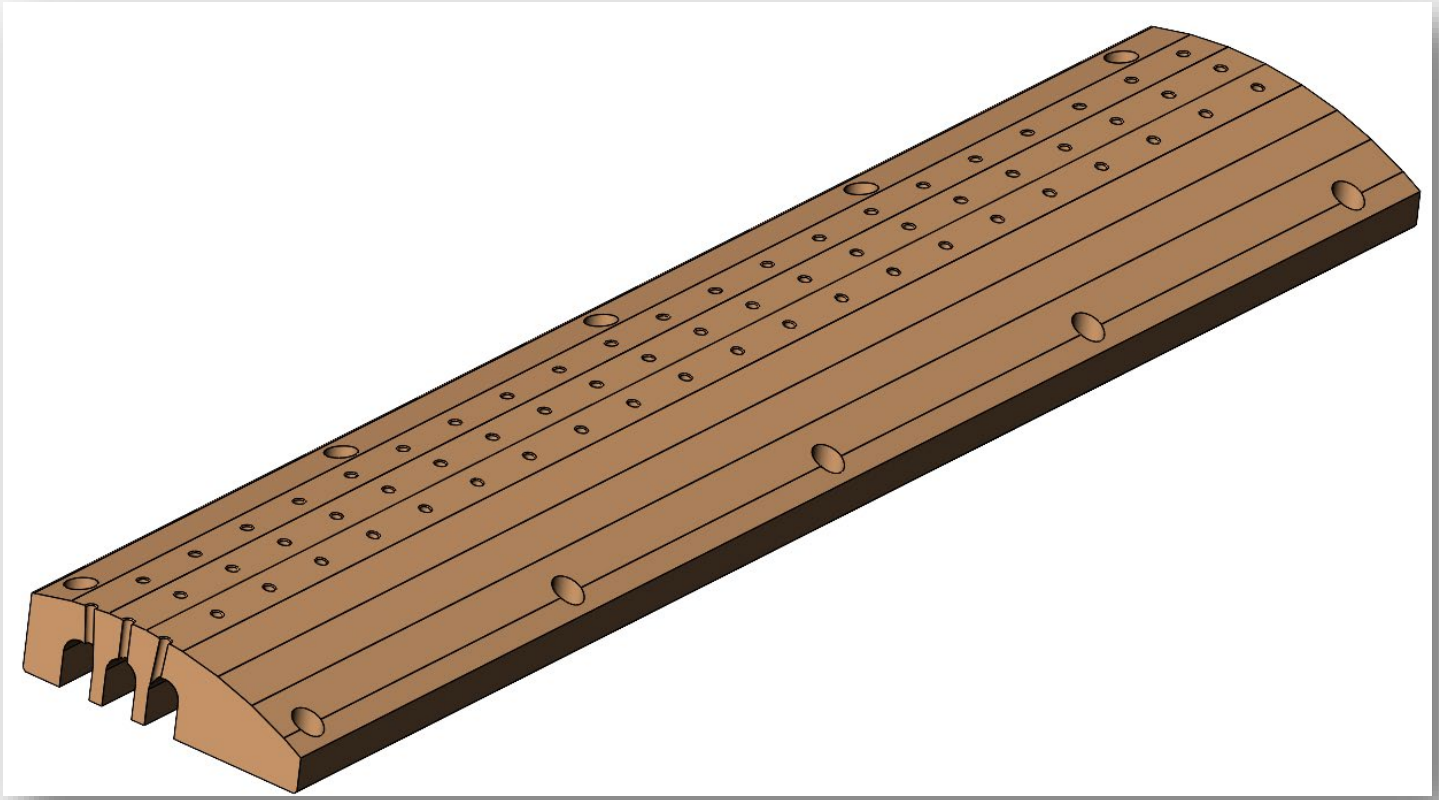
Quick Turn Story

- **Run** machine to identify issues
- **Learn** from performance data
- **Redesign** components to address problems
- **Print** new parts using 3D technology
- **Install** components for testing
- **Re-Run** machine again to validate improvements



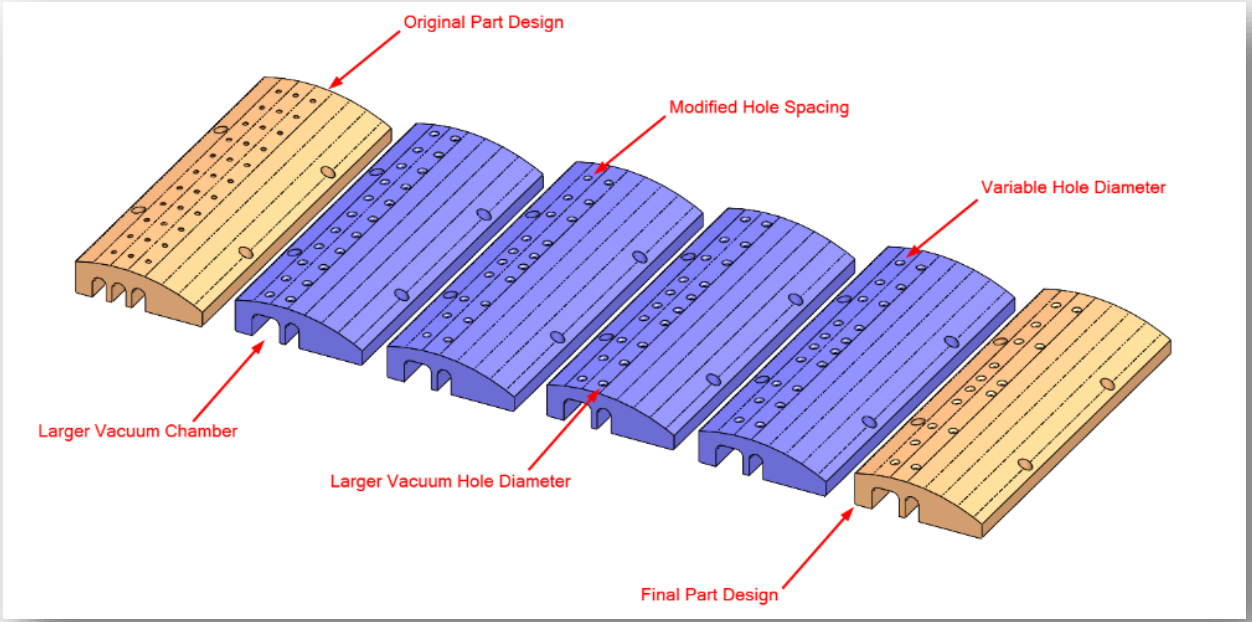
Run and Learn - Quick Turn Story

- Original part analysis revealed design limitations
- Identified specific issues to address:
  - **Inconsistent web handling** during operation
  - **Excessive component wear** reducing lifespan/indicating interferences
  - **Vacuum efficiency problems** affecting product handling



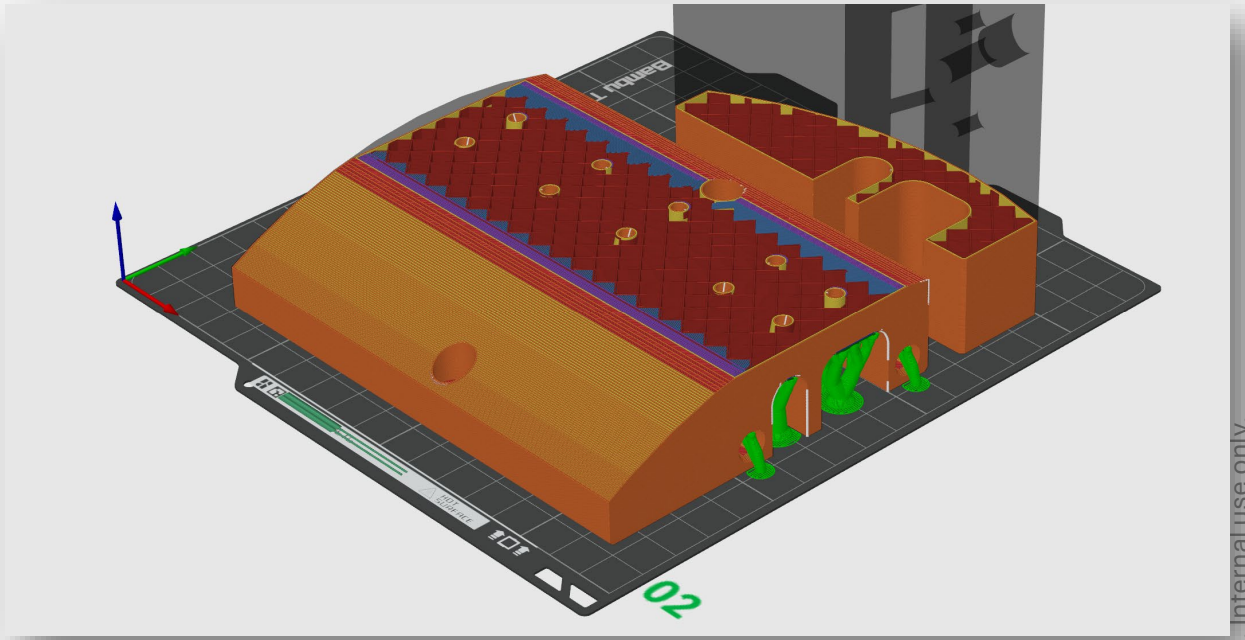
Redesign - Quick Turn Story

- Innovation through Incremental Design
  - Simulation only takes you so far for Non-Woven substrate
  - Enhanced vacuum channel geometry
    - Larger vacuum chamber
    - Modified hole spacing
    - Larger vacuum hole diameter
    - Variable vacuum hole diameter
- Many design iterations are needed



3D Print Learnings - Quick Turn Story

- Developed a Local Community of Practice
  - Printer and slicer capabilities
  - Print best practices
    - Materials, # of walls, infill type, infill %, support, types of support
    - Learn advanced features
  - Printer Operation/Collaboration Tracking Sheet
  - Print Failure Modes and Recovery
- Build Teamwork
  - Rally around a cause



Part Number	Priority	Owner	Printer	Quantity Needed	Total in Progress	Total Complete & Delivered	Print Progress Tracking P = Printing, F = Finished, X = Delivered								Print Settings							Notes
							1	2	3	4	5	6	7	8	Material	Layer Height	Infill	Infill Pattern	Walls	Brim	Supports	
31476517	High	John Bessey	PCMC Core One #1	30	30	30	X	X	X	X	X	X	N/A	N/A	PLA	0.15mm	10%	Rectilinear	2	No	No	Print Standing on End Need 30 complete parts, .001.01 & .001.02 are split halves. It does not matter which way the parts are printed so long as the total is correct.
31476517		John Bessey	PCMC Core One #2				X	X	X	X	X	X	X	X	PLA	0.15mm	10%	Rectilinear	2	No	No	
31476517.001.01		Eric Jensen	Home				X	X	X	X	X	X	X	X	PLA	0.15mm	10%	Rectilinear	2	No	No	
31476517.001.02		Eric Jensen	Home				X	X	X	N/A	N/A	N/A	N/A	N/A	PLA	0.15mm	10%	Rectilinear	2	No	No	
31476517.001.02		John Bessey	PCMC Core One #1				X	X	X	X	N/A	N/A	N/A	N/A	PLA	0.15mm	10%	Rectilinear	2	No	No	
31476517.001.02		Cory Schubring	Home				X	X	X	X	X	N/A	N/A	N/A	PLA	0.15mm	10%	Rectilinear	2	No	No	
31461911.3DP	Mid	John Bessey	PCMC XL	2	2	2	X	X	N/A	N/A	N/A	N/A	N/A	N/A	PLA	0.2mm	15%	Rectilinear	Standard	No	No	Print with groove facing upward 5-7 top surface layers (wear surface)
31461911.002.3DP	Mid	John Bessey	PCMC XL	2	2	2	X	X	N/A	N/A	N/A	N/A	N/A	N/A	PLA	0.2mm	15%	Rectilinear	Standard	No	No	Print with groove facing upward 5-7 top surface layers (wear surface)

3D Print Learnings - Quick Turn Story

- Install/run
  - Did we solve our problems
- Many design cycles
  - Performed daily design cycle iterations from November, ‘24 to April, ’25
- Start with 3D Print prototyping right away.

Look Familiar?

Process Timeline Comparison

	Week 1					Week 2					Week 3					Week 4				
	Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday
Additive Manufacturing	3D Modeling	Slicing / Printing	Printing	Test in Machine	Update 3D Model	Slicing / Printing	Printing	Test in Machine	Update 3D Model	Slicing / Printing	Printing	Test in Machine	Update 3D Model	Slicing / Printing	Printing	Test in Machine	Update 3D Model	Slicing / Printing	Printing	Test in Machine
Conventional Production	3D Modeling	Quoting	Cut PO	Leadtime Day 1	Leadtime Day 2	Leadtime Day 3	Leadtime Day 4	Leadtime Day 5	Shipping / Receiving	Test in Machine	Update 3D Model	Quoting	Cut PO	Leadtime Day 1	Leadtime Day 2	Leadtime Day 3	Leadtime Day 4	Leadtime Day 5	Shipping / Receiving	Test in Machine

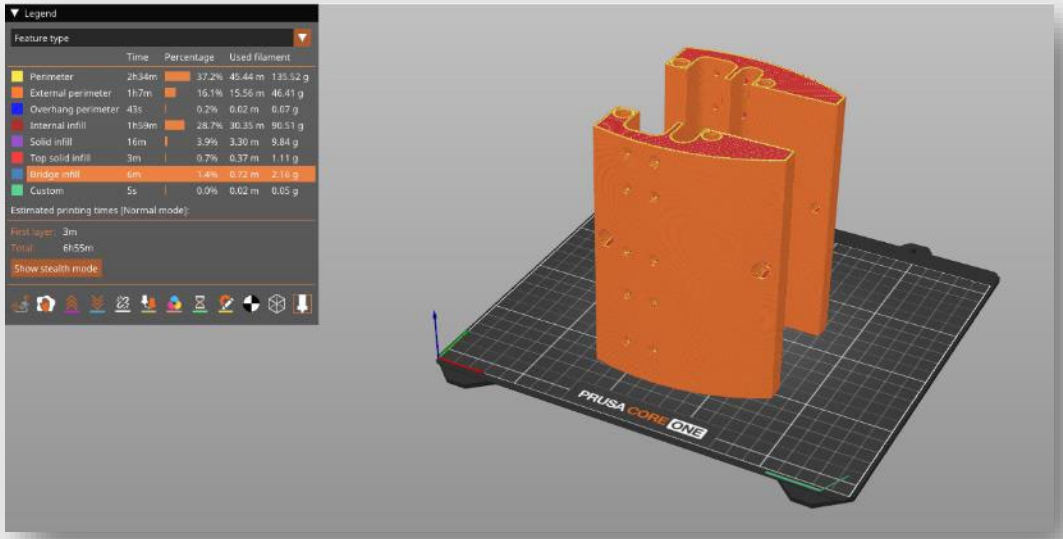
Additive Manufacturing:

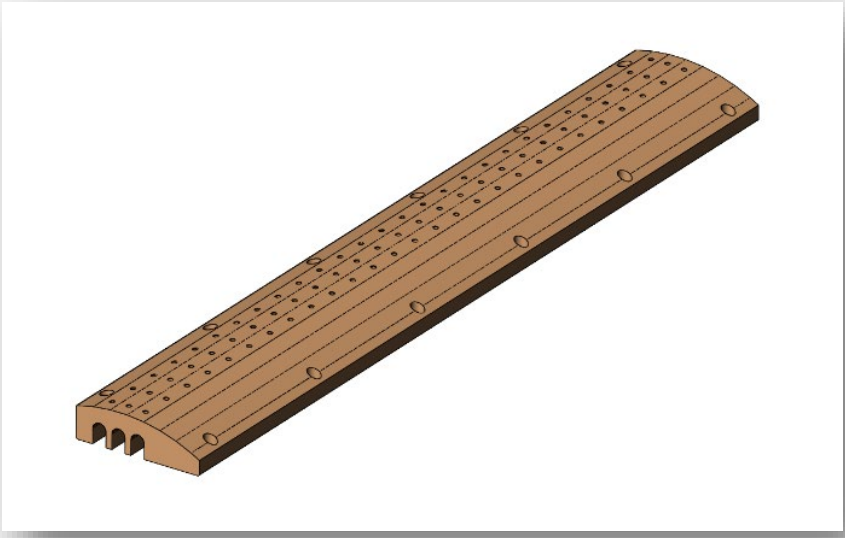
- Quick iterations and part production
- Cuts out traditional bottle-necks
- Doesn't rely on outside resources (vendors, transportation, etc)

Conventional Production:

- Complex system with slow results
- Requires involvement from several departments and processes
- Subject to delays

Process Cost Comparison





Additive Manufacturing:

- Cost of material ($8)
- Cost of printer wear and tear ($28)
- $432 per iteration - $192 in material

Conventional Production:

- Cost of machined Acetal part ($630)
- Cost of internal operations
- 30-day lead time
- $15,120 per iteration

Process Impacts and Key Takeaways

- Validated in-house printing capabilities
- New 3D printers
  - Greatly increased part production and decreased testing down-time
- Exposed team members to additive manufacturing
- Facilitated mindset shifts regarding 3D printing in a test environment

WHERE, WHEN, WHY to use AM?

Real world BW examples illustrating Applications, Processes, and Value

AMC Capabilities

Parker Will
Hygiene Engineering Excellence Leader
BWC - GB

John Bessey
Engineer

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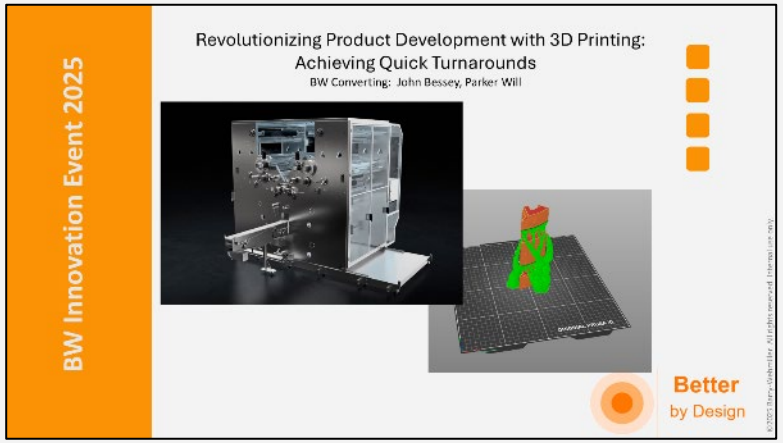
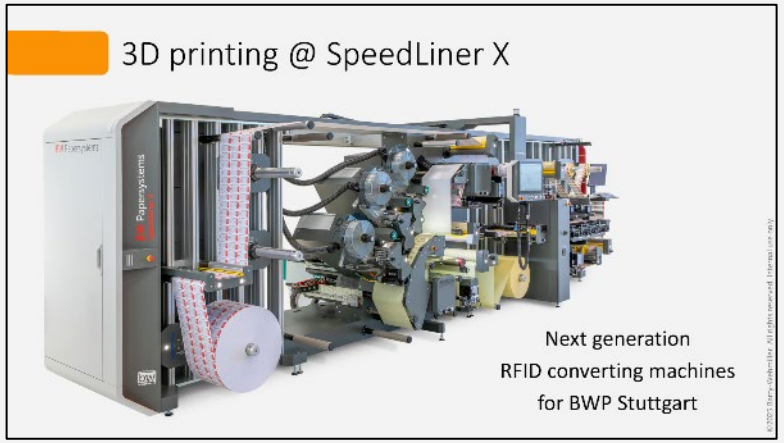
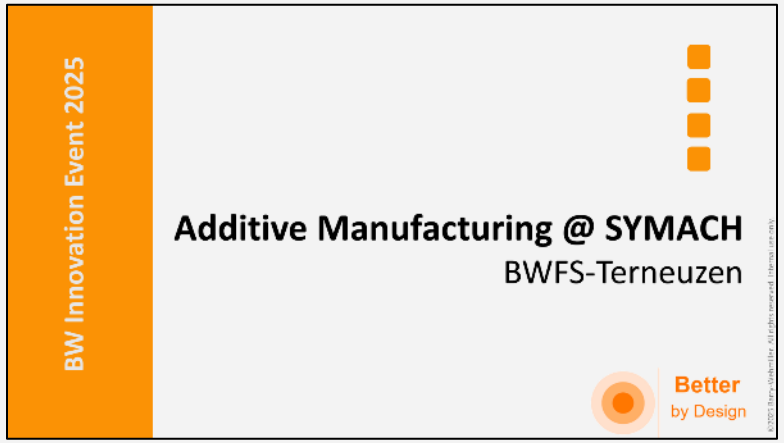
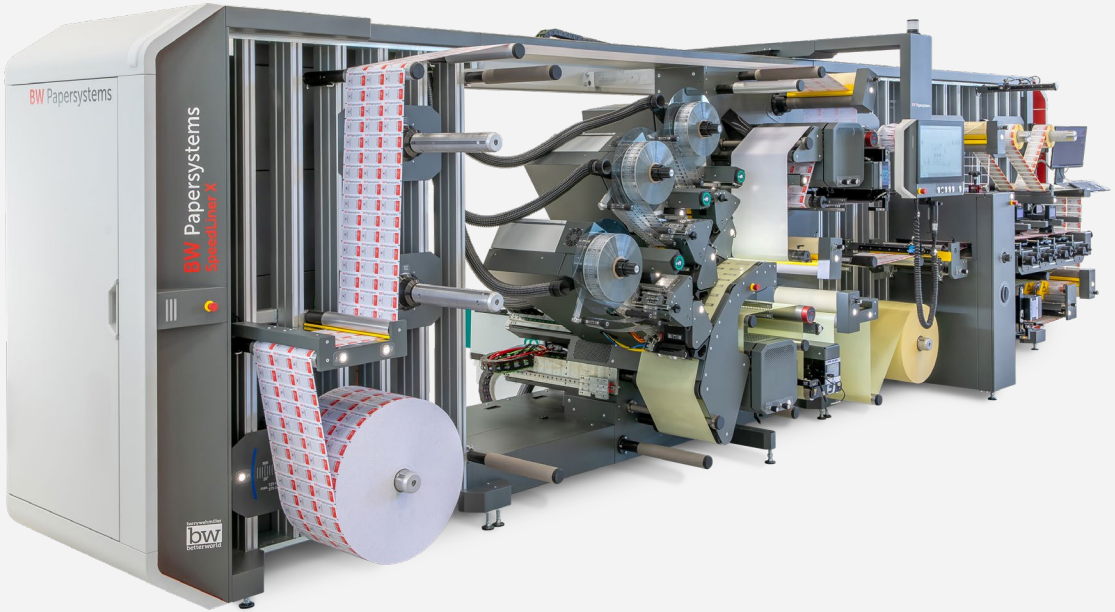
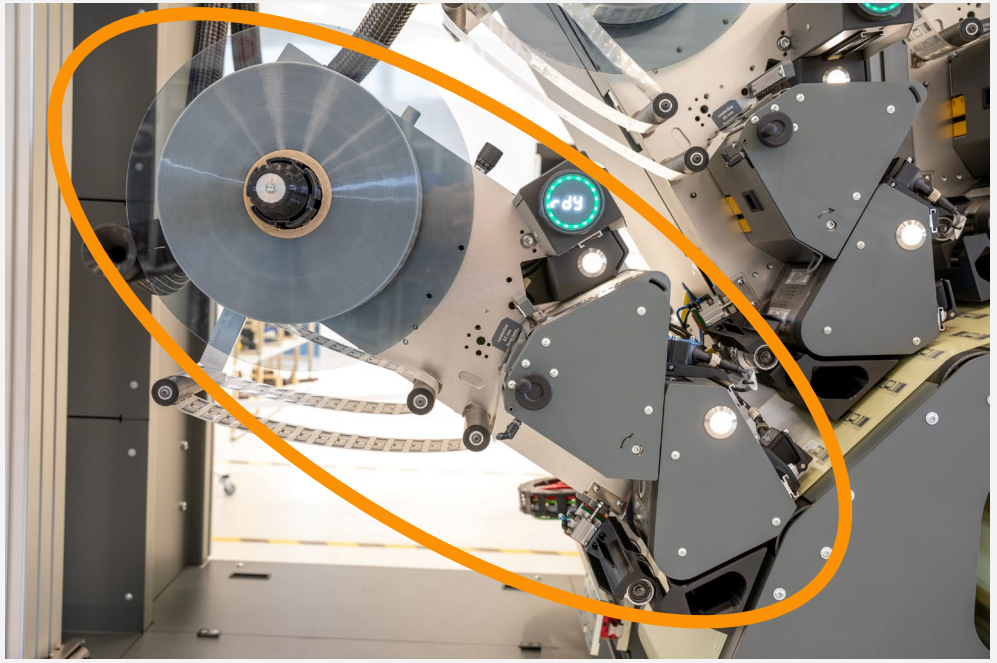






3D printing @ SpeedLiner X





The next generation RFID converting machines for BWP Stuttgart feature an entirely new designed **attaching module** for the RFID inlays!

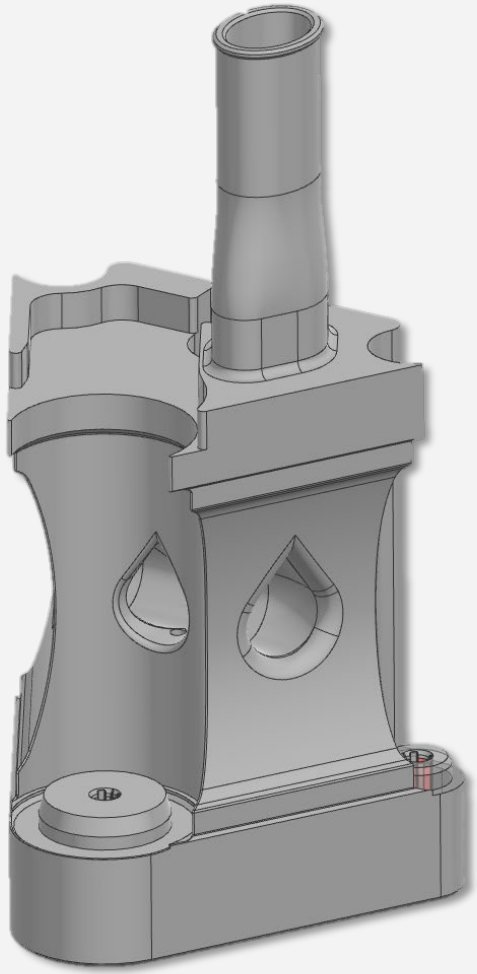
It is the key-component! Everything had to be invented from scratch!

Fast iteration with 3D printing

Vacuum suction box for the attaching module of SpeedLiner X!

Initial idea:

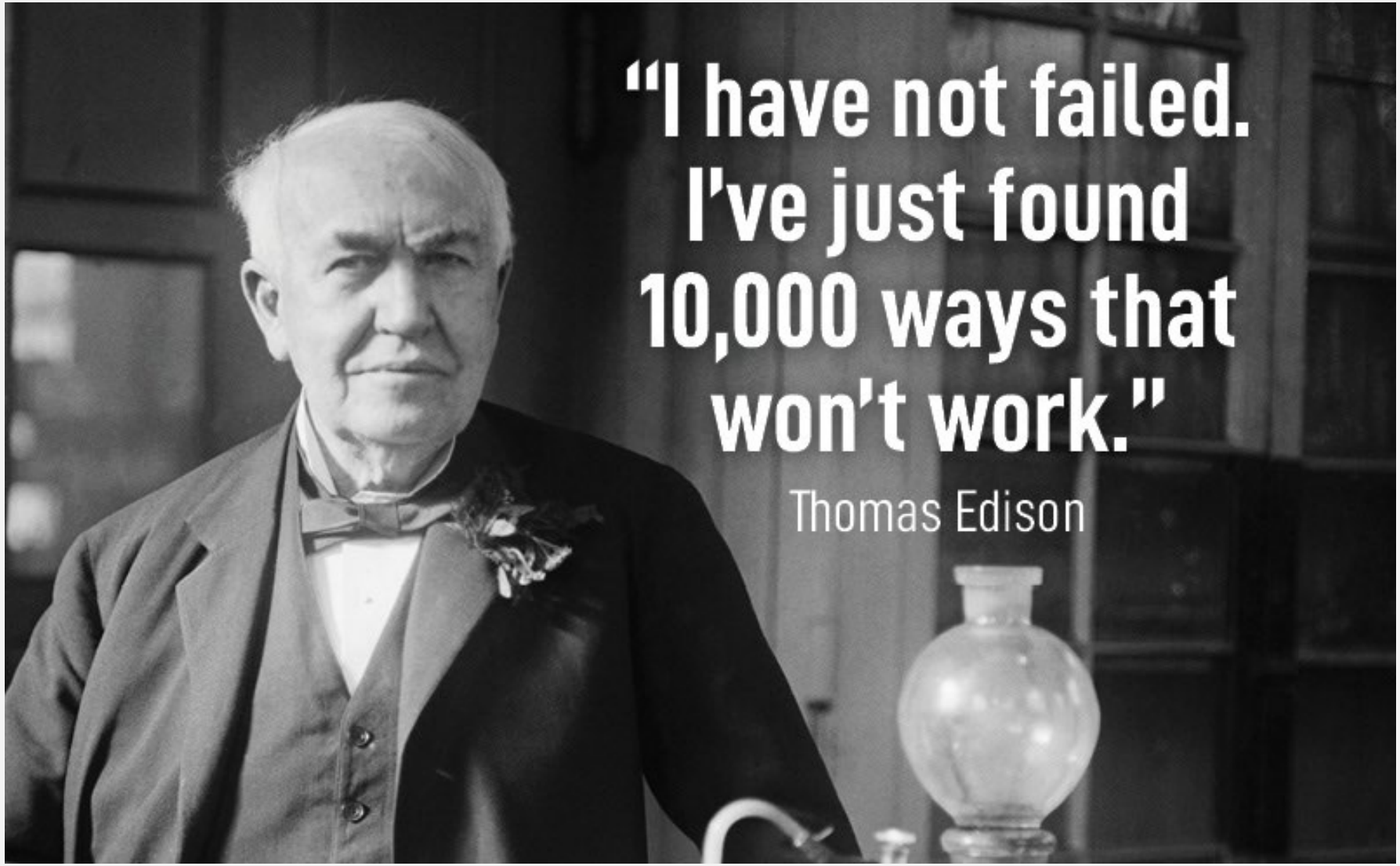
- 3D printed
- Single piece design
- No leakage



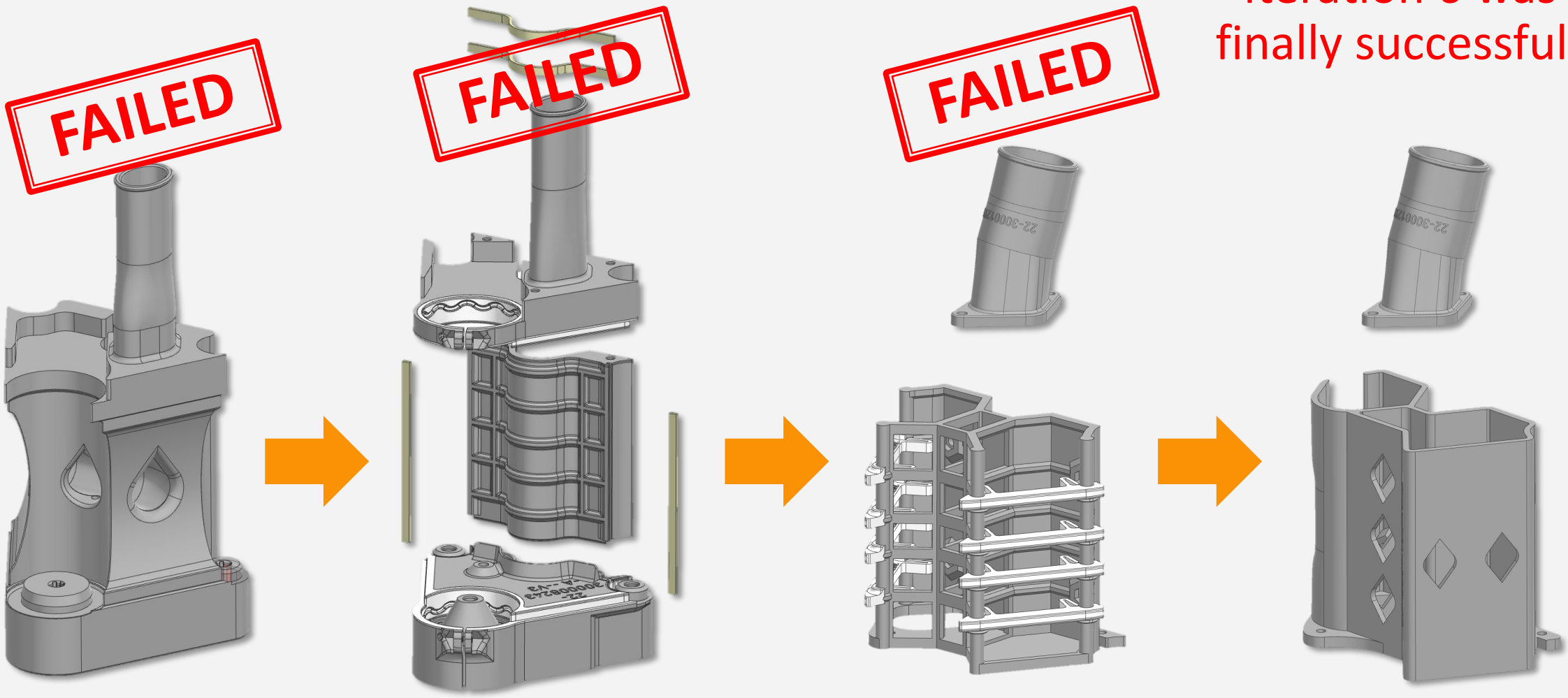
Initial design/idea

#1

Fast iteration with 3D printing



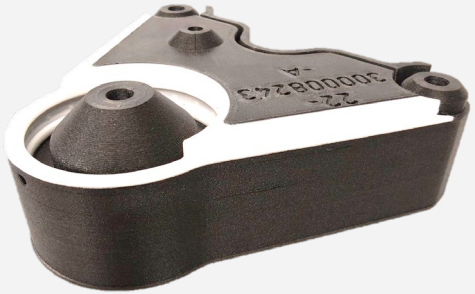
Fast iteration with 3D printing



Fast iteration with 3D printing

Single piece design

#1



Combining materials

#3

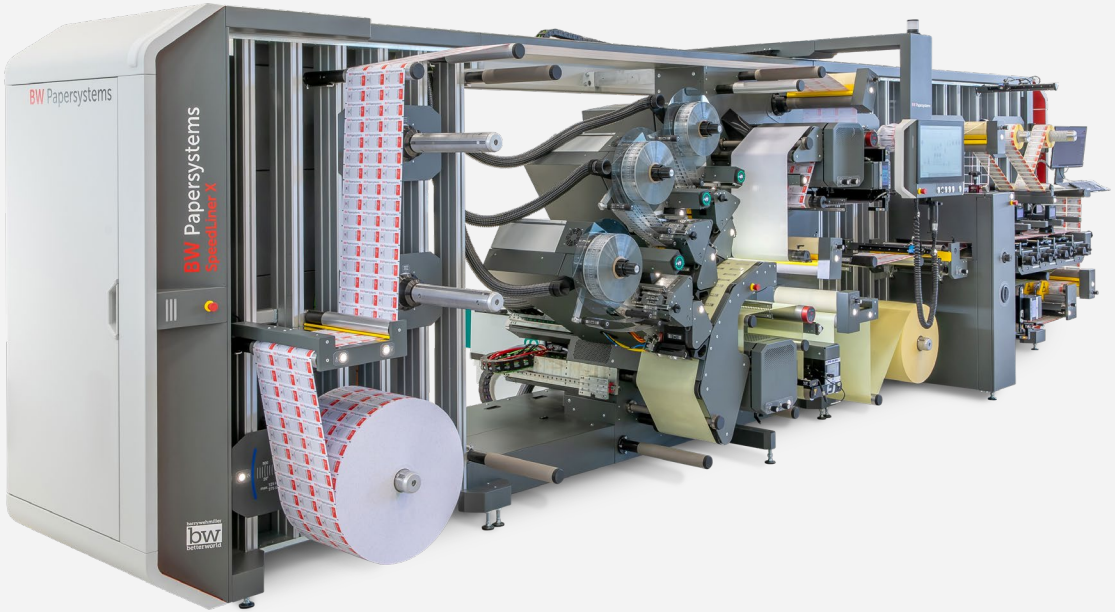
Combining parts

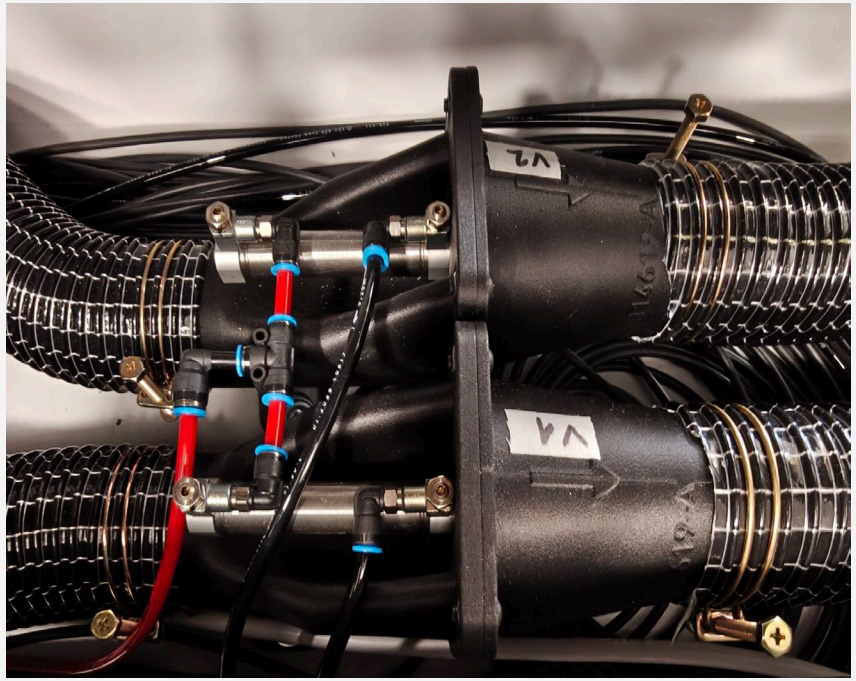
#4

One piece

#6

3D printing @ SpeedLiner X



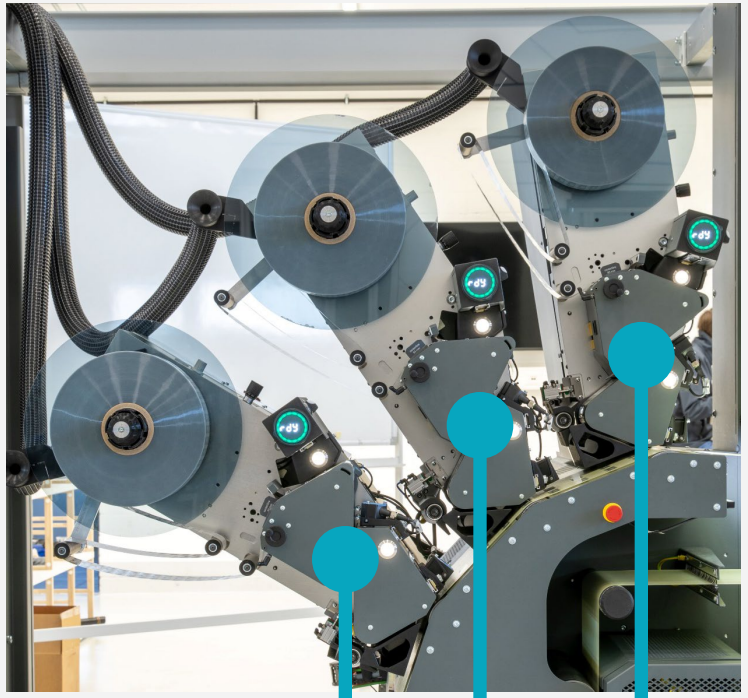


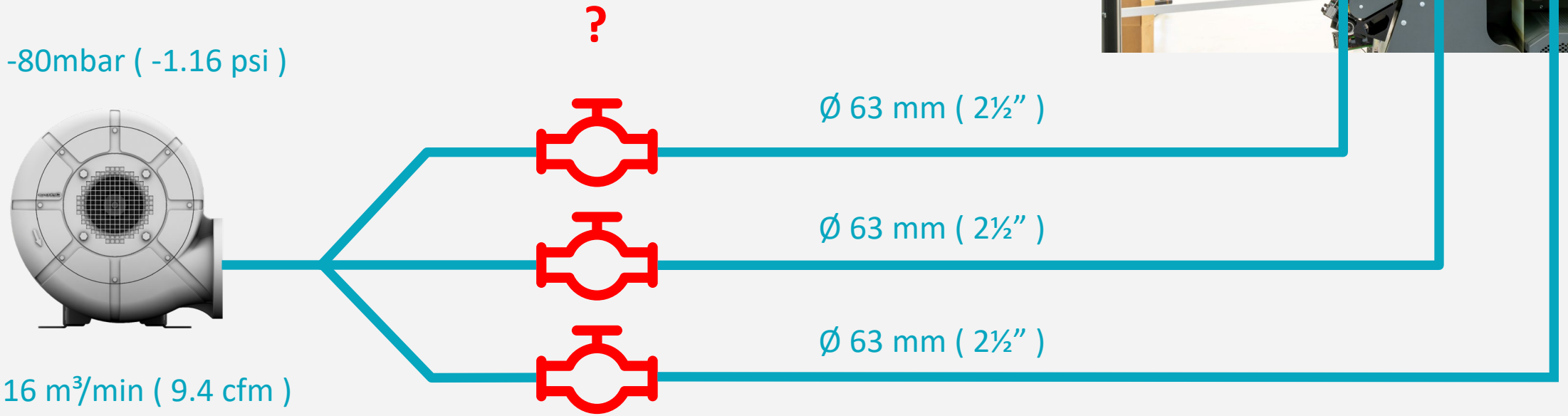
With the SpeedLiner X, we also redesigned the vacuum system completely!

3D printed vacuum valve

How to switch on / off vacuum:

- Big hose diameter
- Fast
- Compact
- Cost effective





3D printed vacuum valve

Option 1

2½” BÜRKERT valve

≈ 350,- $

(5,2 kg / 11,5 lbs)

Option 2

2½” MAC valve series 59

≈ 600,- $

(6,3 kg / 14 lbs)

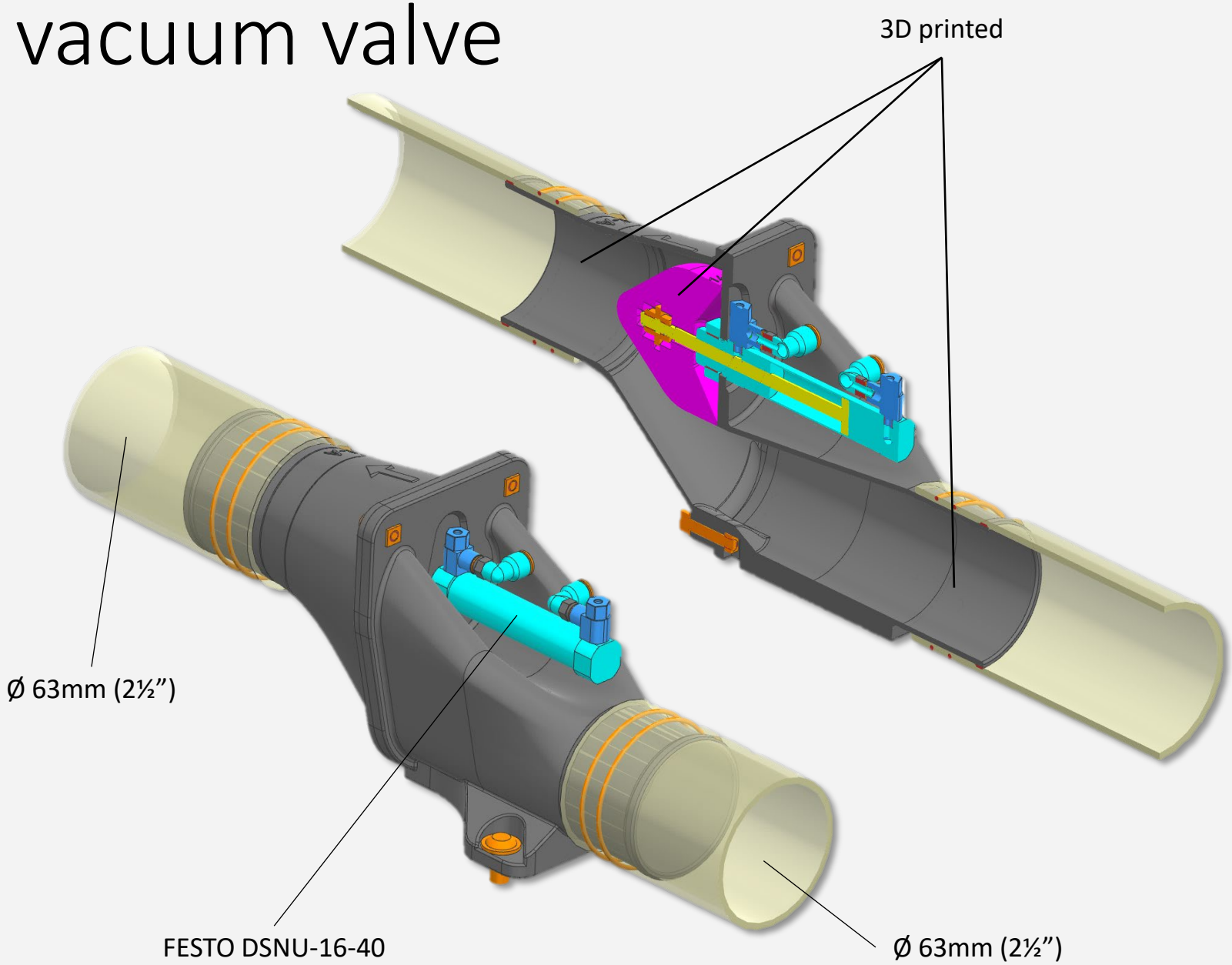
Option 3

2½” TAMESON pinch valve

≈ 1000,- $

3D printed vacuum valve

Our solution:
pneumatically operated
“bathtub plug”

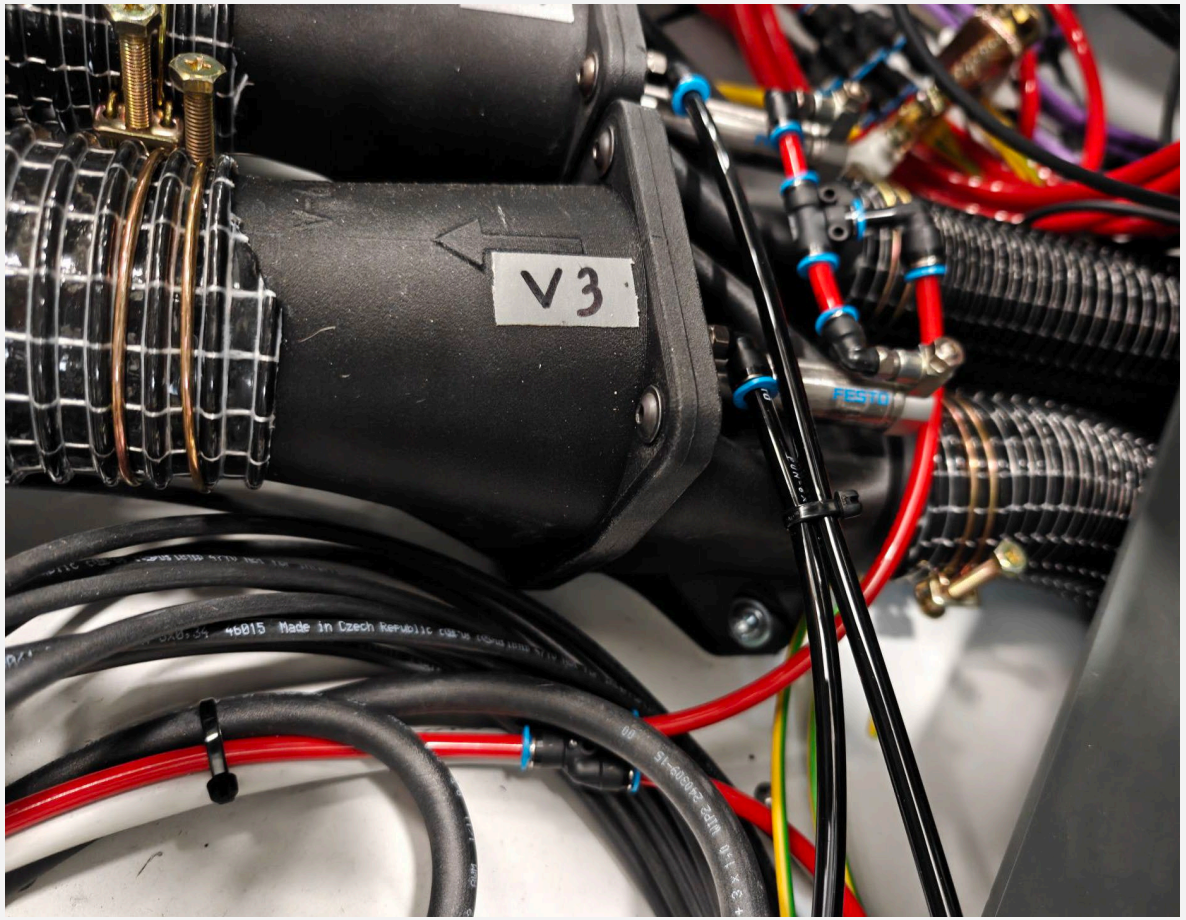


Almost no restriction
to the airflow!

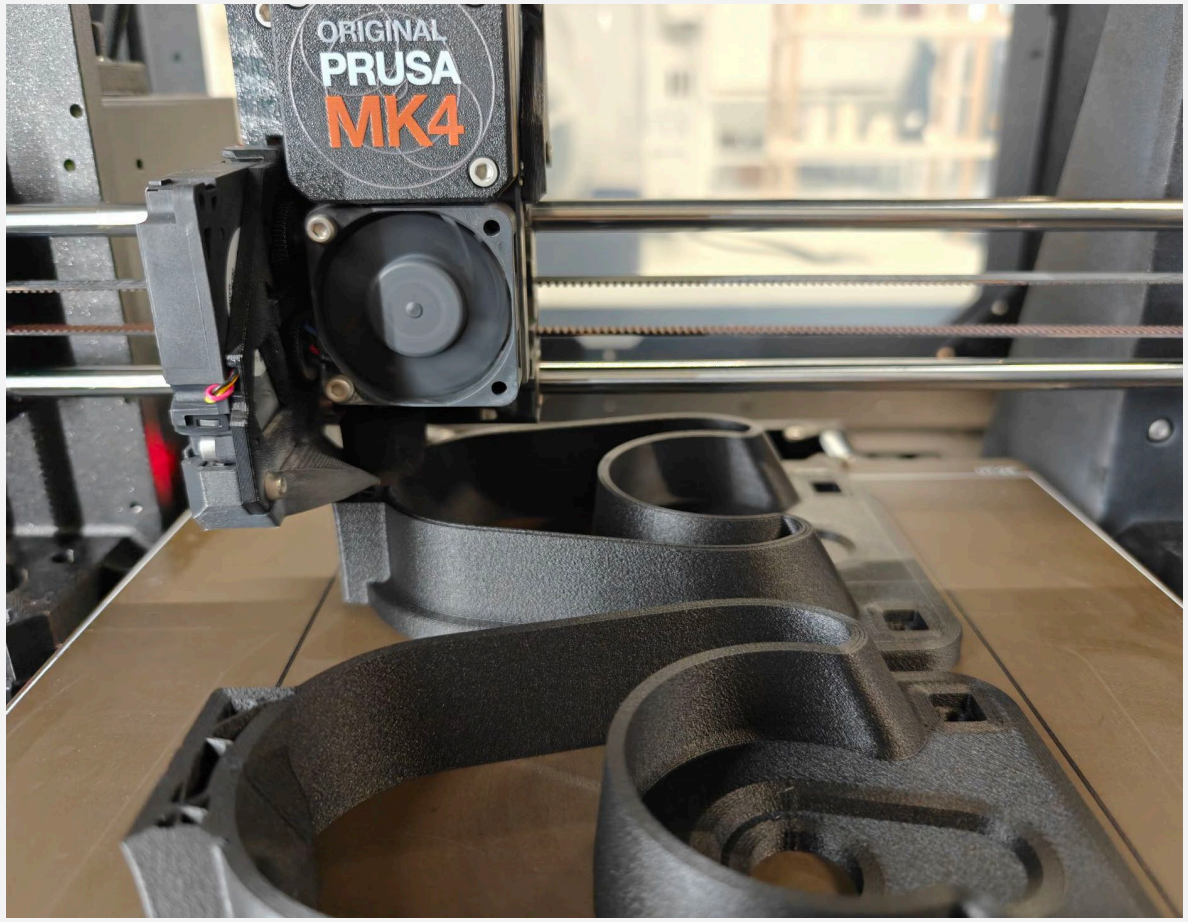
(pressure loss < 1 mbar / 0.014 psi)

3D printed vacuum valve

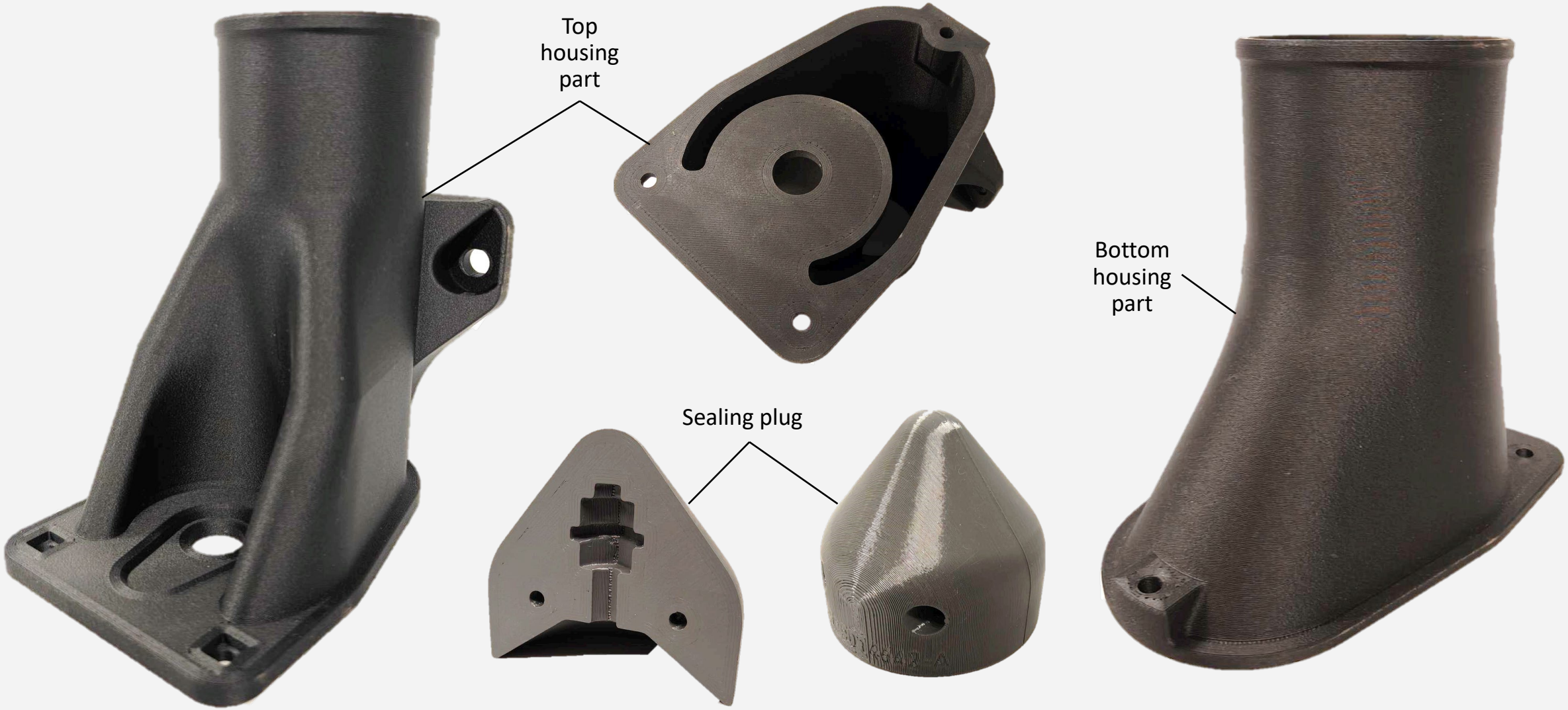
Completely assembled in the machine



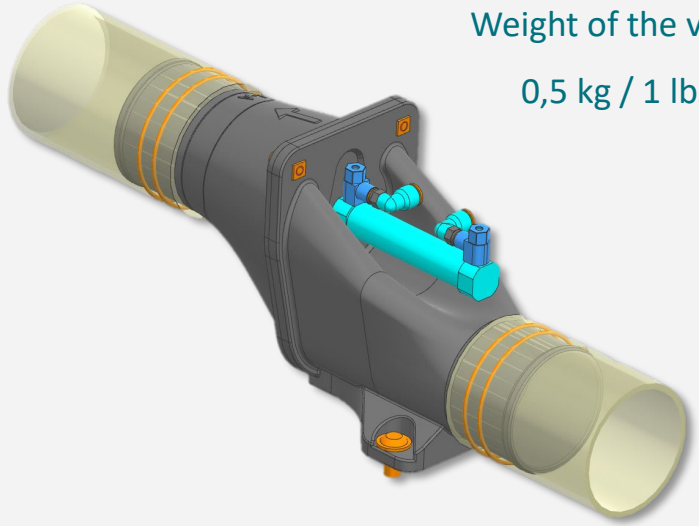
Creation of two housing parts



3D printed vacuum valve



3D printed vacuum valve



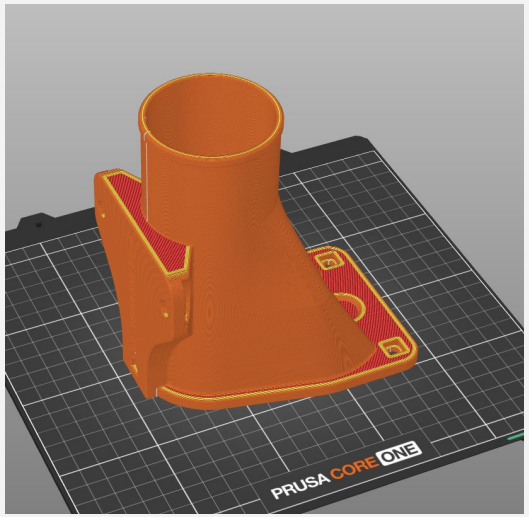
Weight of the valve:

0,5 kg / 1 lbs)

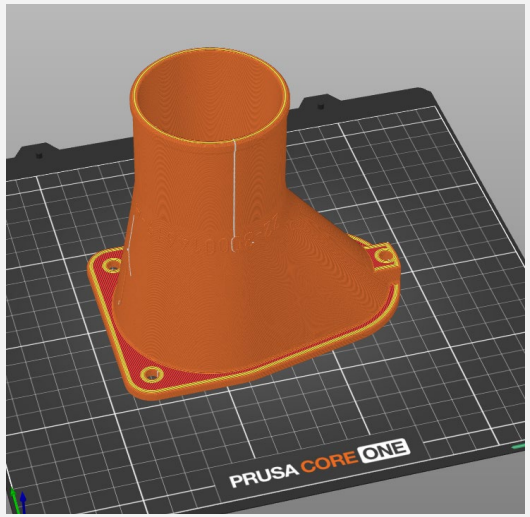
Printer hourly rate AMC: 6 $

Total print time: 12:30h

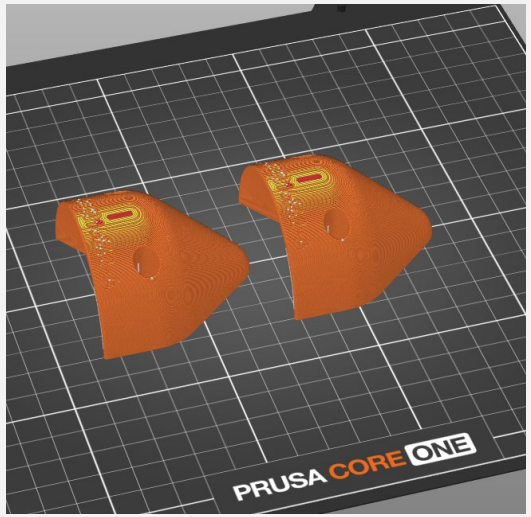
Material consumption: 400g



Part 1
6:30 h



Part 2
3:45 h



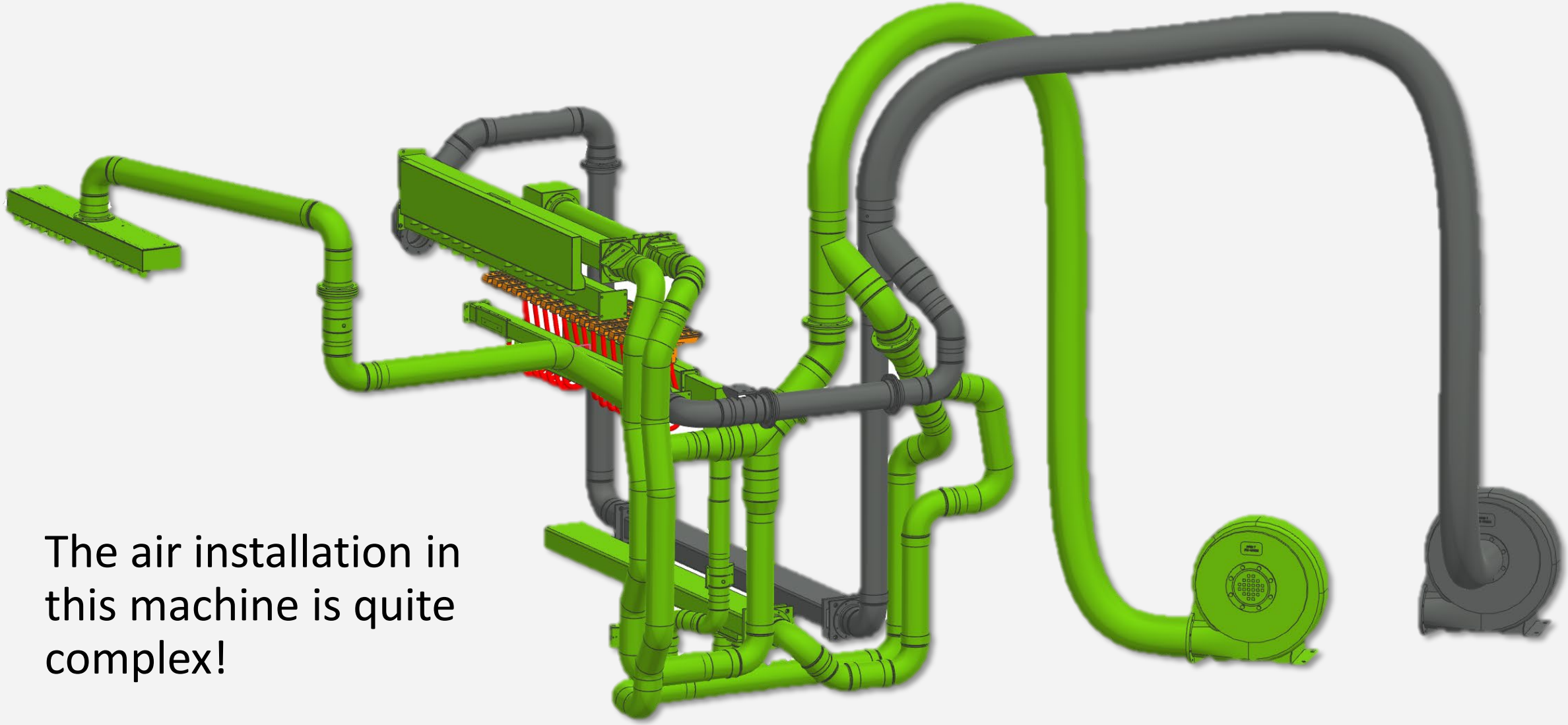
Part 3
2:15 h

Part 1	39,- $
Part 2	22,50 $
Part3	13,50 $
Cylinder	25,- $
Assembly cost + small parts	50,- $
Total	**150,- $**

3D printing improves air distribution

Questec – ultra compact folio size sheeter with “Airstream technology”

3D printing improves air distribution



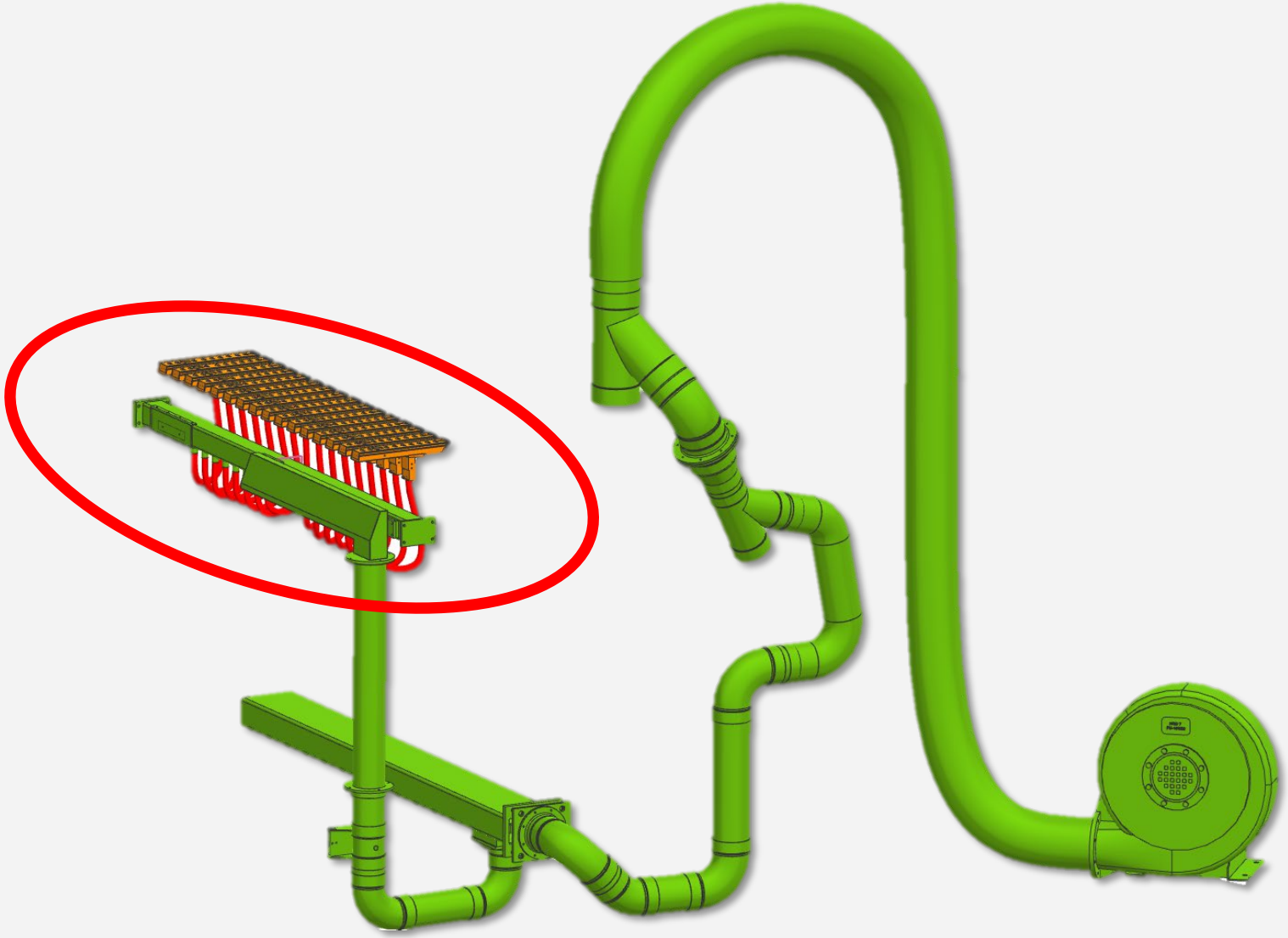
The air installation in this machine is quite complex!

3D printing improves air distribution

One of the airstream tables suffered from insufficient air supply!

Safe operation could not be guaranteed!

The team already looked for a bigger blower!



3D printing improves air distribution

We lost 62 % of our pressure on the “last mile” because of conventional welded air distribution channels and small hoses!

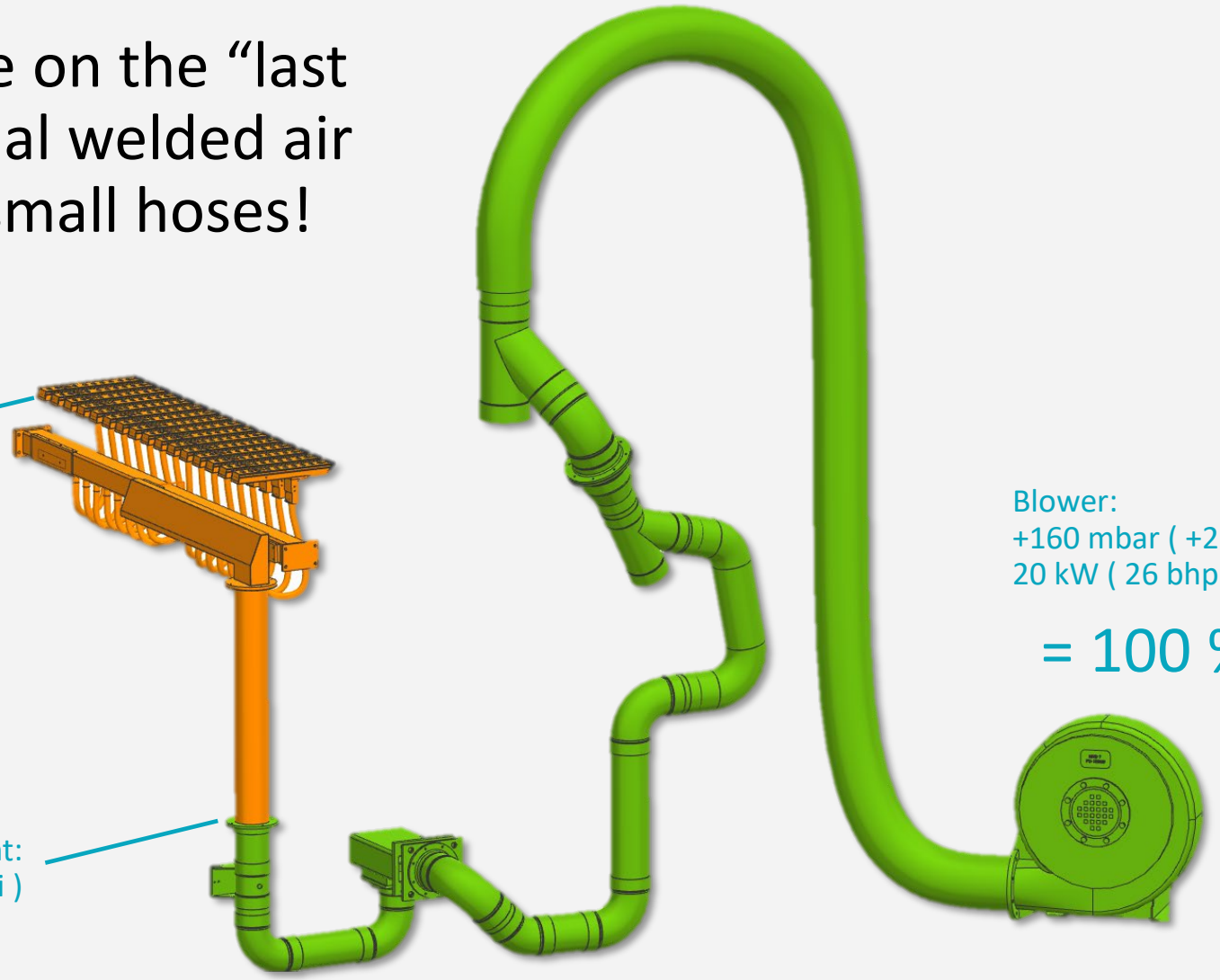
≈ 18 %

Airstream table:
+30 mbar (+0.44 psi)
(+80 mbar would have been needed!)

- 62 %

≈ 80 %

Measuring point:
+128 mbar (+1.88 psi)



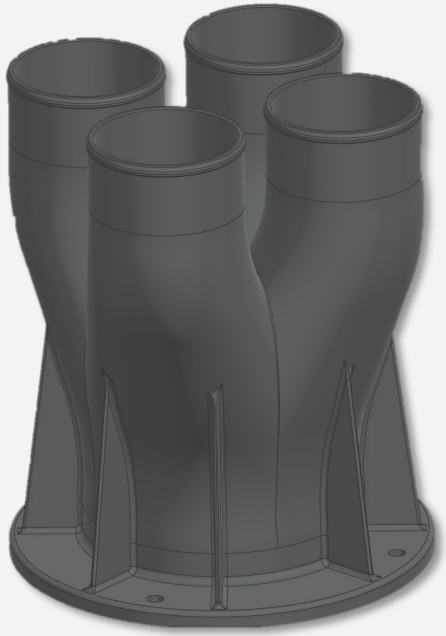
Blower:
+160 mbar (+2.32 psi)
20 kW (26 bhp)

= 100 %

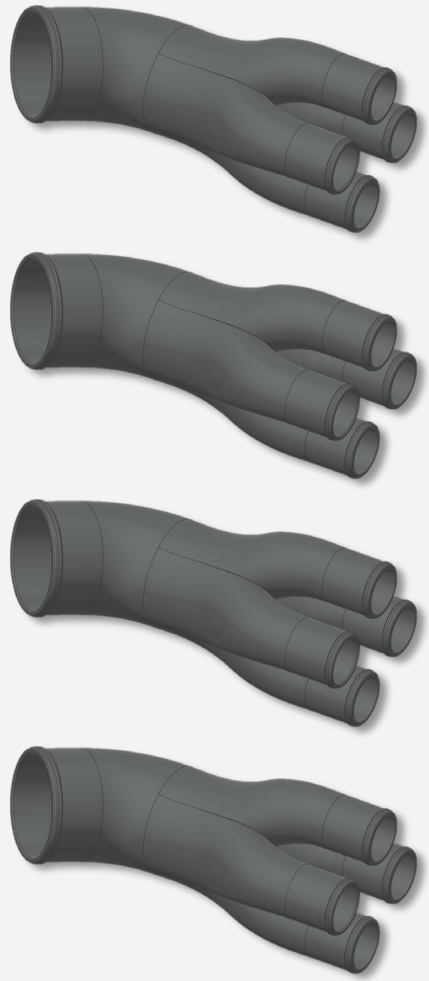
3D printing improves air distribution

We replaced the welded parts on the “last mile” with 3D printed aerodynamically designed components!

- Designed on Friday
- Printed over the weekend
- Installed Monday morning
- First tests started Monday afternoon



1 piece
Ø 106 mm → 4x Ø 63 mm



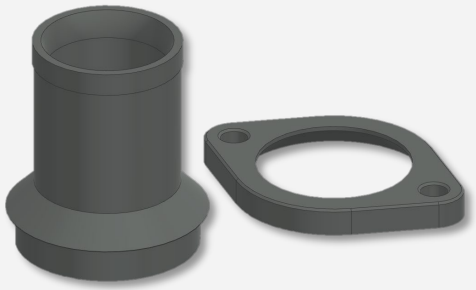
4 pieces
Ø 63 mm → 4x Ø 25 mm

16 pieces
Ø 25 mm

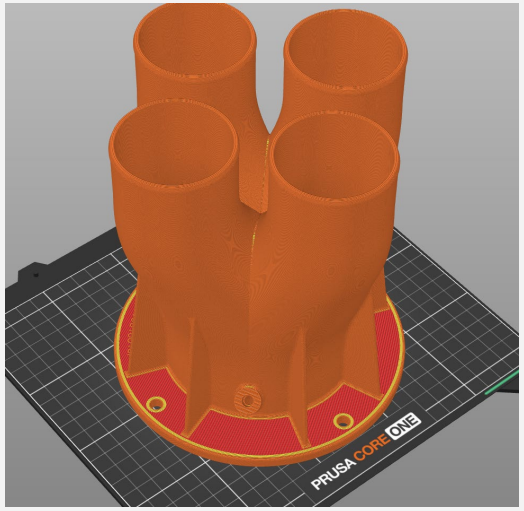
3D printed ducting

Printer hourly rate AMC: 6 $
Total print time: 48h
Material consumption: 1610g

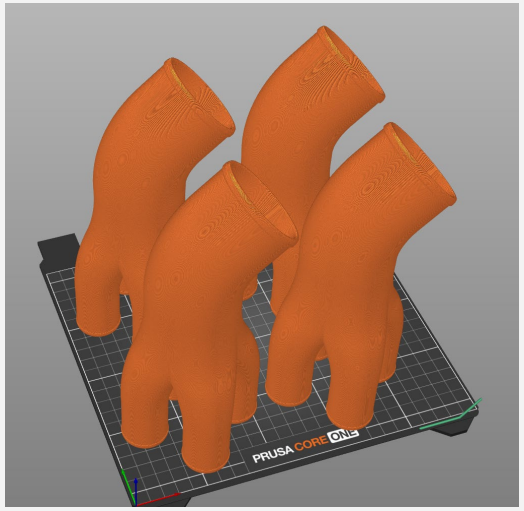
Part 3 purposefully designed in two pieces



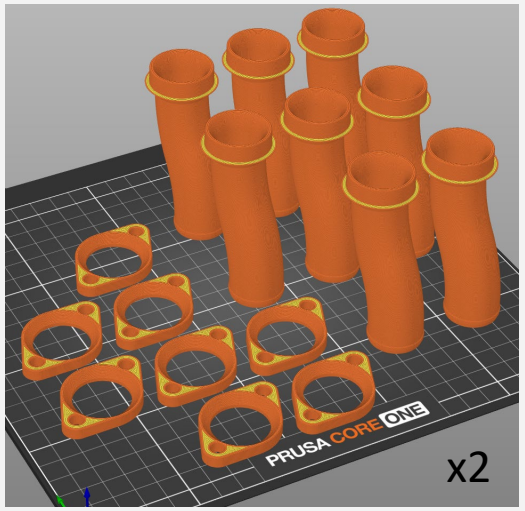
No need for support
easier / faster / cleaner



Part 1 (1pc)
12:00 h



Part 2 (4pcs)
21:00 h



Part 3 (16pcs)
15:00 h

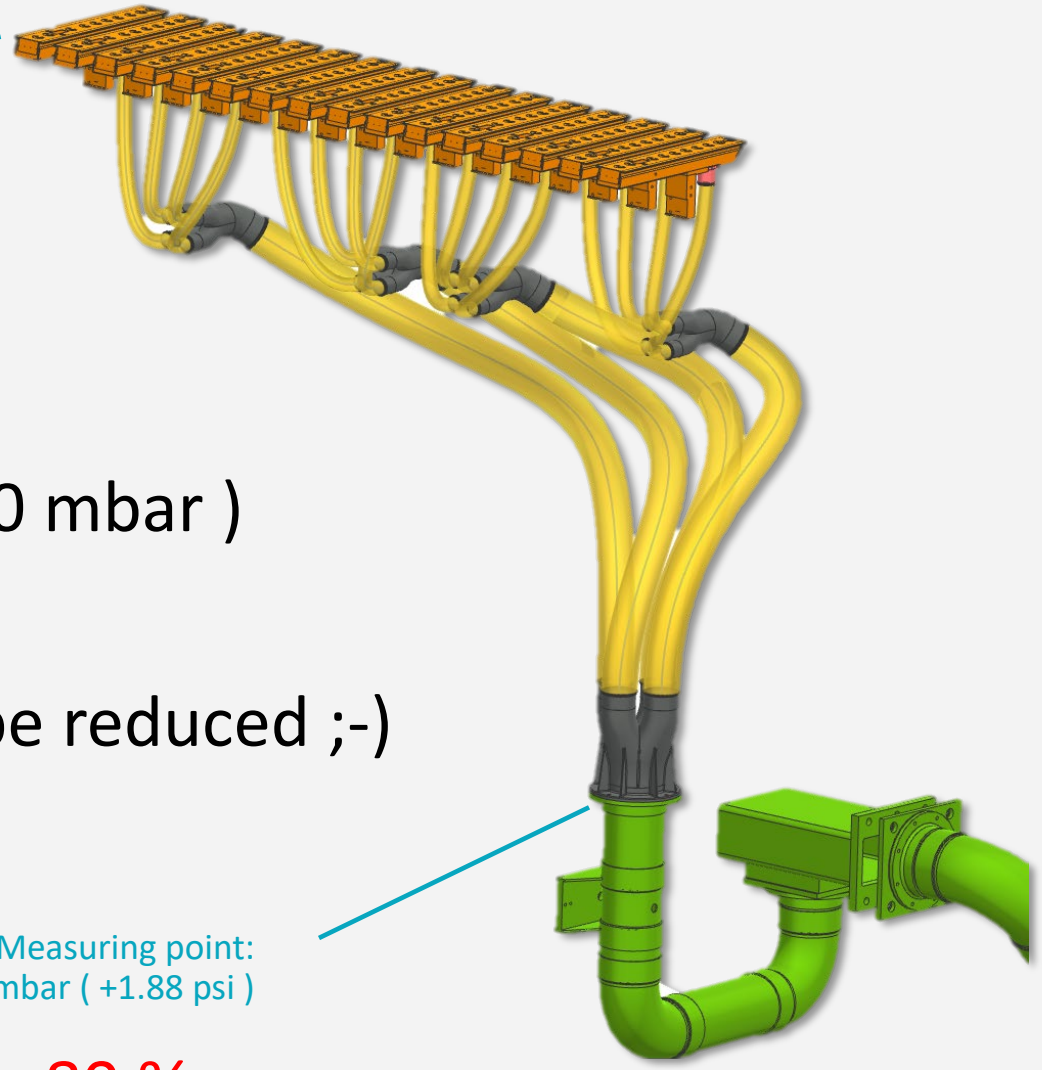
Part 1 (1pc)	72,- $
Part 2 (4pcs)	126 $
Part3 (16pcs)	90 $
Hoses	100,- $
Assembly cost + small parts	250,- $
Total	**638,- $**

3D printing improves air distribution

Airstream table:
+90 mbar (+1.3 psi)

(+80 mbar would have been needed!)

≈ 56 %



- Pressure loss was reduced by 38% (60 mbar)
- Existing blower could be retained
- Speed of existing blower could even be reduced ;-)

Measuring point:
+128 mbar (+1.88 psi)

≈ 80 %

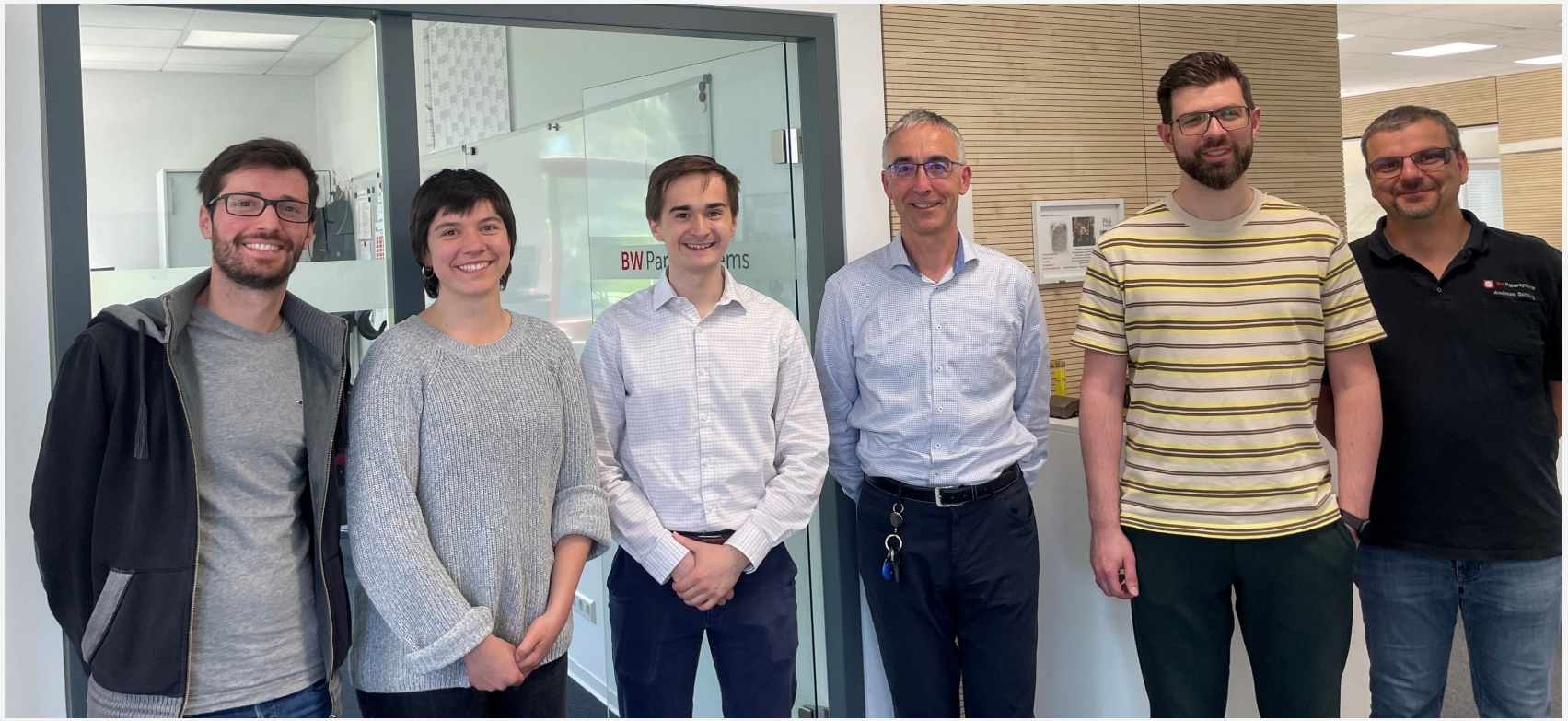
3D printing improves air distribution

… and we started to transfer these learnings across BW Papersystems!

International Know How Exchange

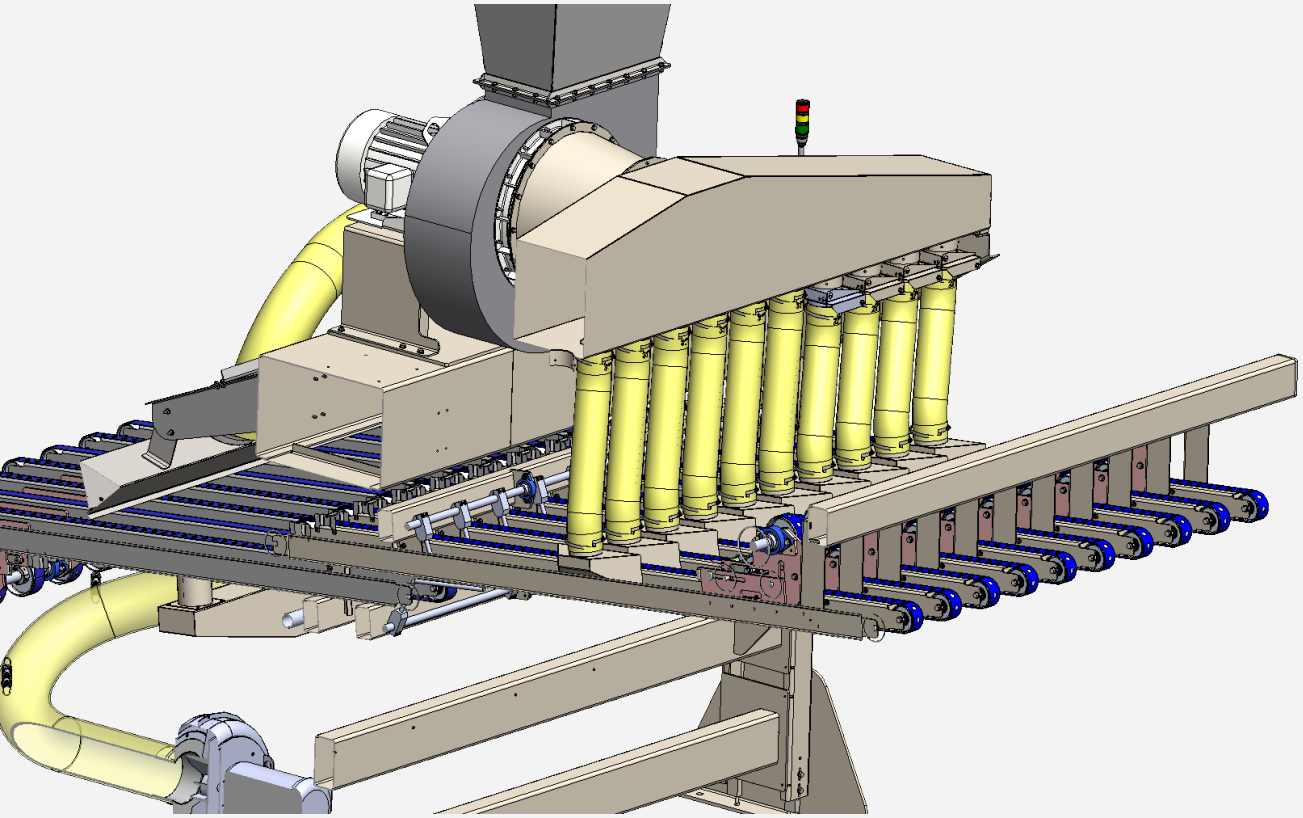
We had the pleasure to welcome Jacob in Stuttgart!

He was working for 3 month with us!



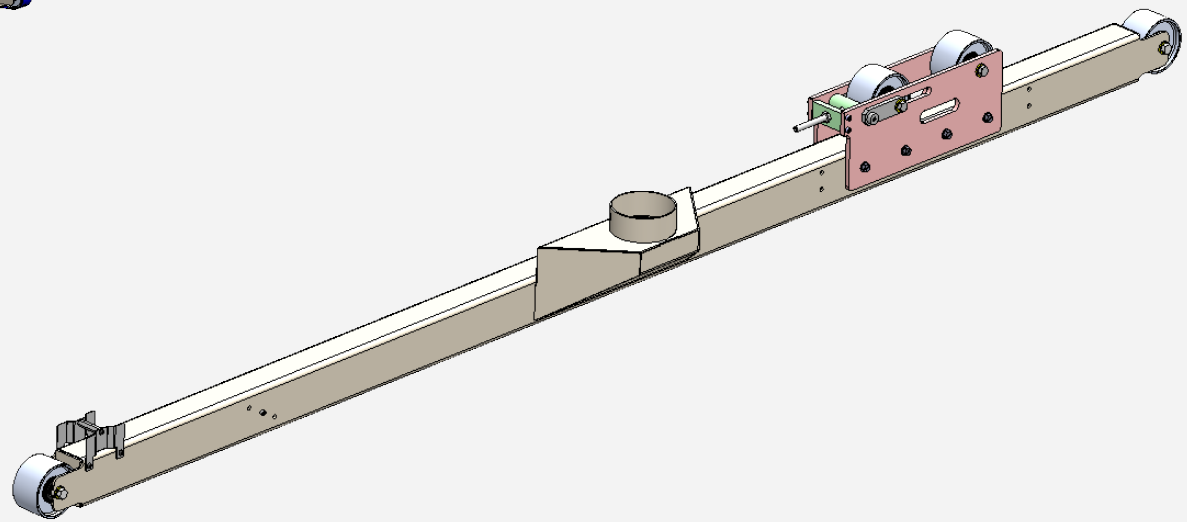
Christian Berger | Elisa Jara | Jacob Strojny | Hansjörg Klein | Artur Konrad | Andi Schilling

Vacuum Overhead Stacker

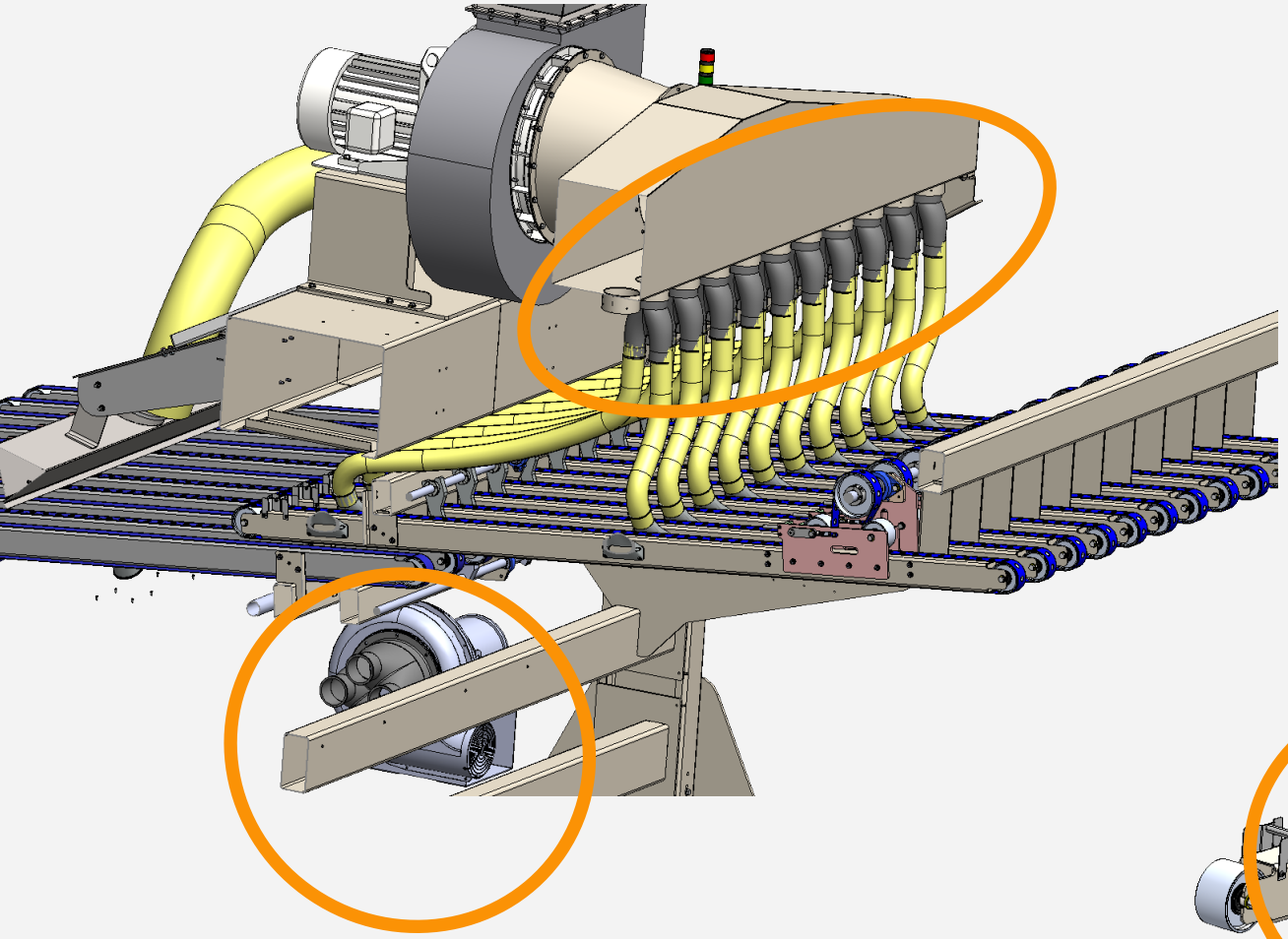


Current VOS incline design:

- Complex and expensive weldment
- Not aerodynamically efficient

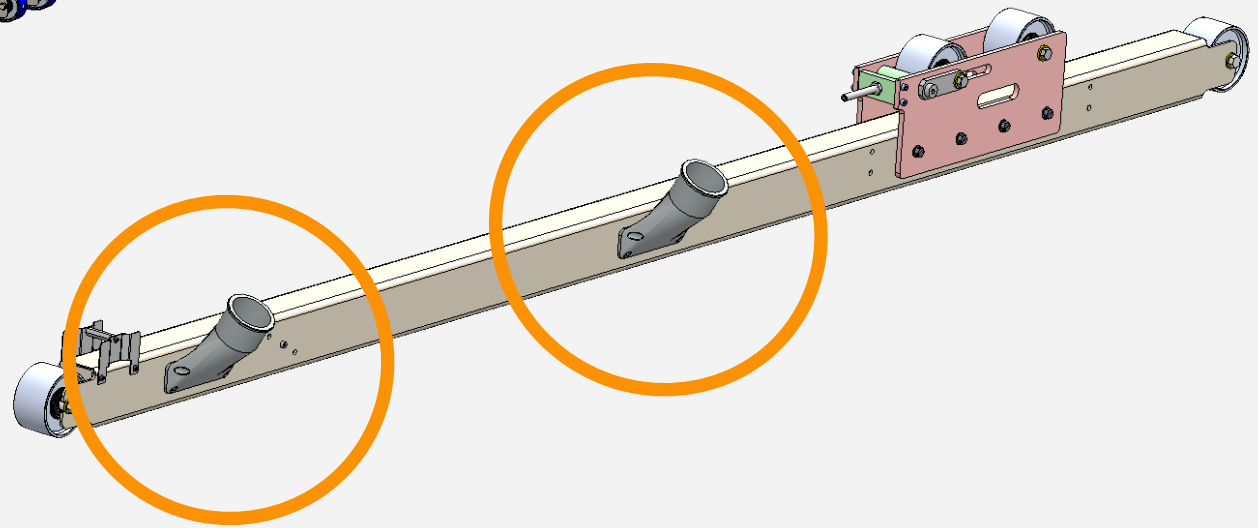


Vacuum Overhead Stacker

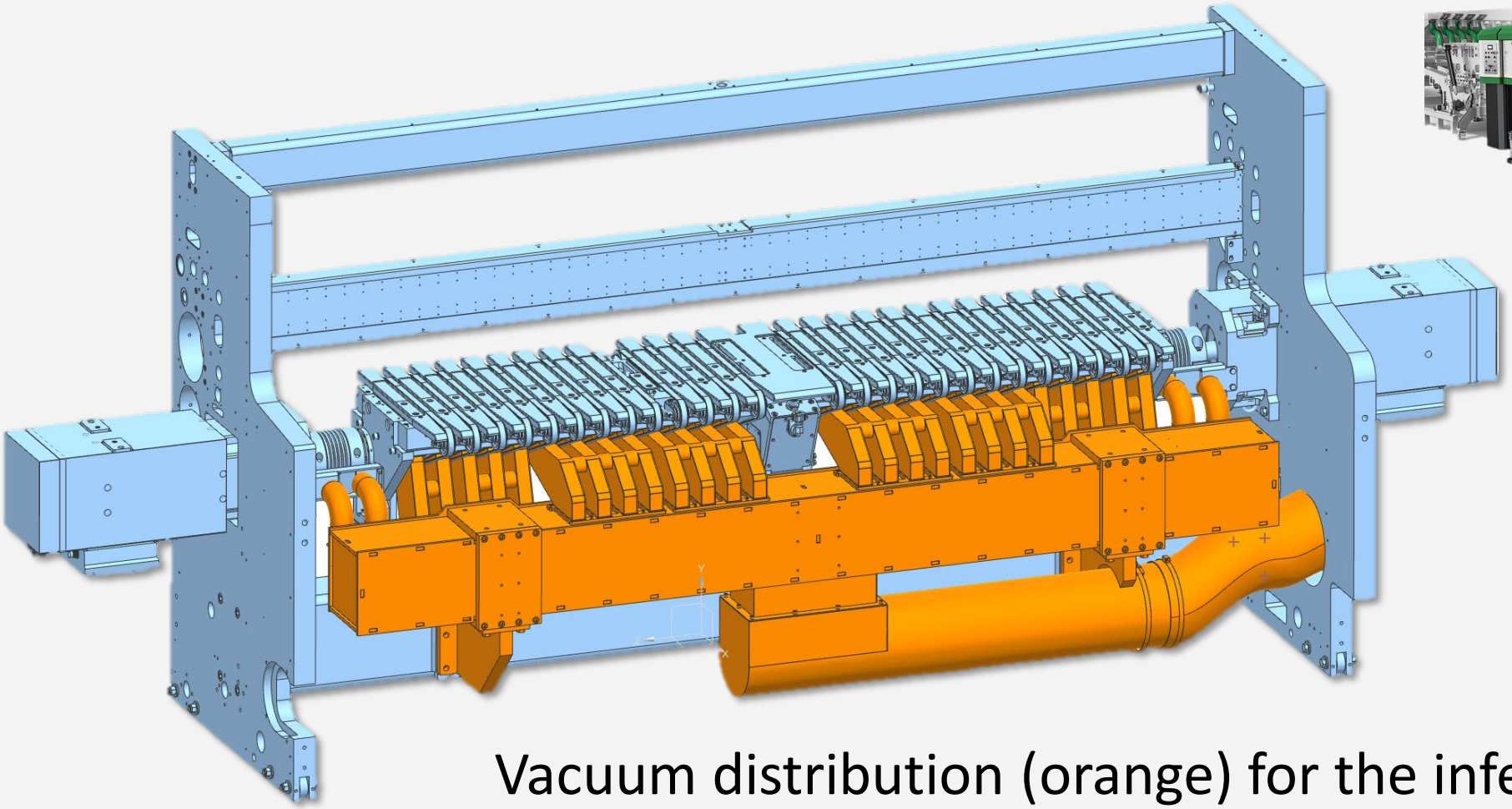


Potential redesign idea:

- 3D printed parts
- Improved aerodynamics
- Reduced complexity of weldment



ServoPro RDC Vacuum Infeed



Zach Fischer

Baltimore Team

Vacuum distribution (orange) for the infeed table is currently a massive steel weldment/assembly!

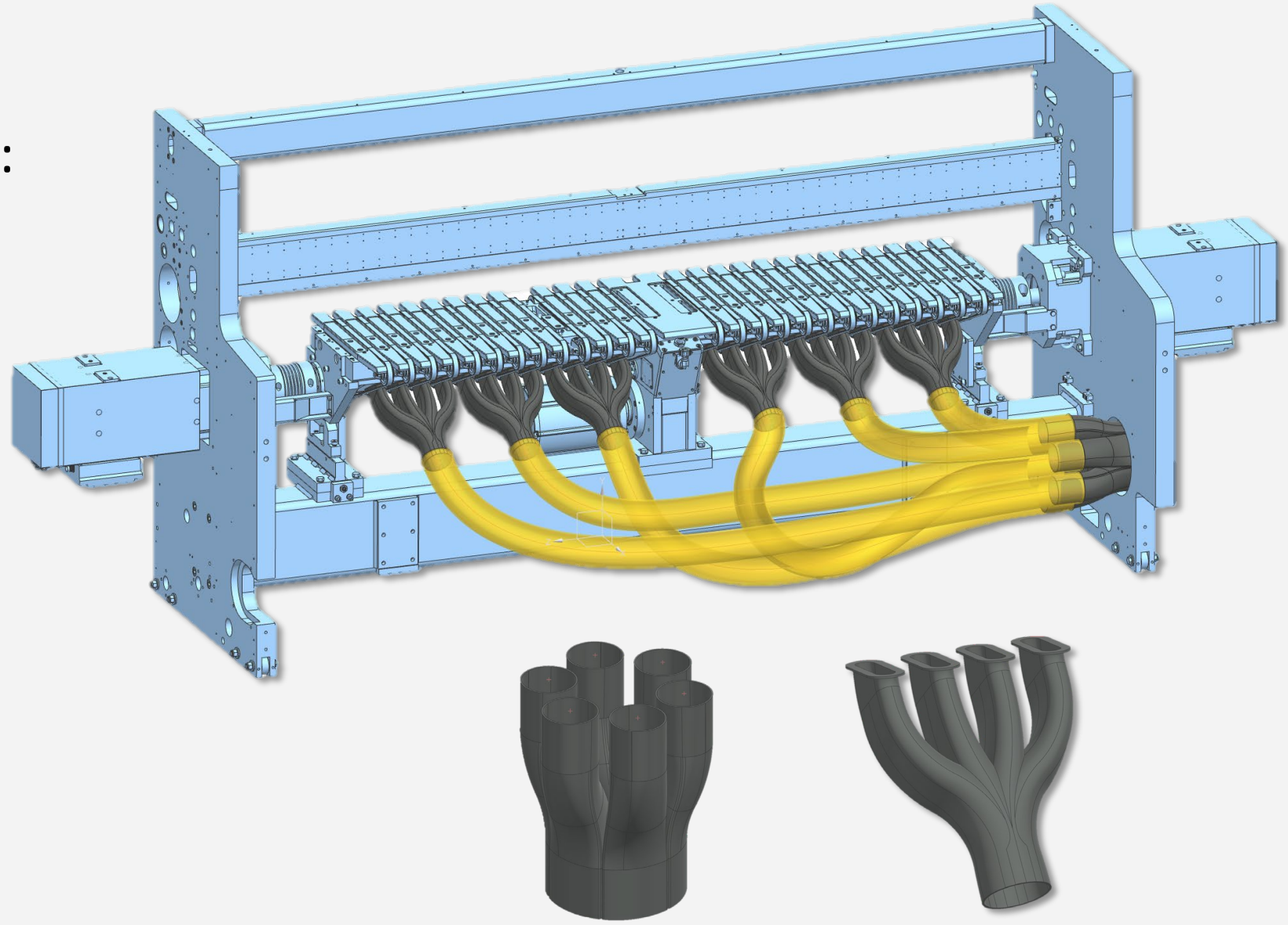
≈ 450 kg (990 lbs)

ServoPro RDC Vacuum Infeed

Potential redesign idea:

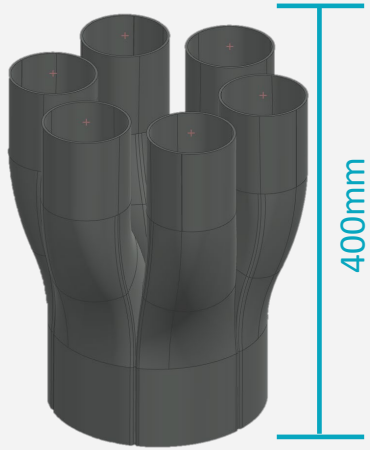
- 3D printed parts
- standard hoses
- Improved aerodynamics
- No inventory
- Lower cost

≈ 14 kg (30 lbs)

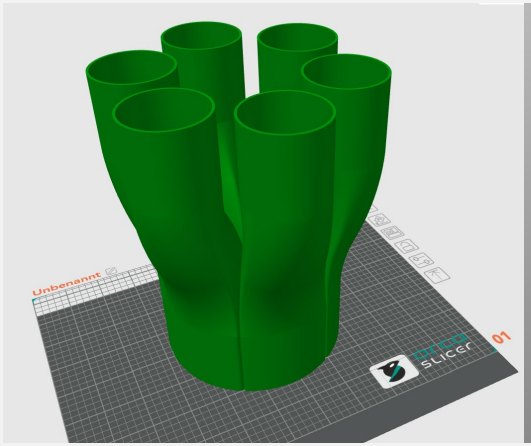


AMC capable of larger FDM prints

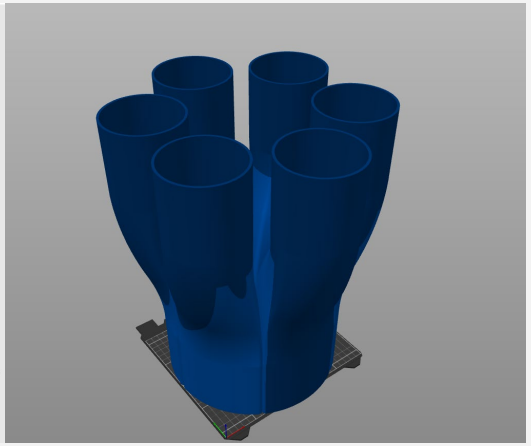
AMC printer



Local printer



EL-140



CoreONE

AMC	External vendor
FDM	SLS
ABS	PA12
500,- $	**3900,- $**

WHERE, WHEN, WHY to use AM?

Real world BW examples illustrating Applications, Processes, and Value

Parker Will
Hygiene Engineering Excellence Leader
BWC - GB

John Bessey
Engineer

BWC - GB

Andreas Schilling
Mechanical Chief Engineer

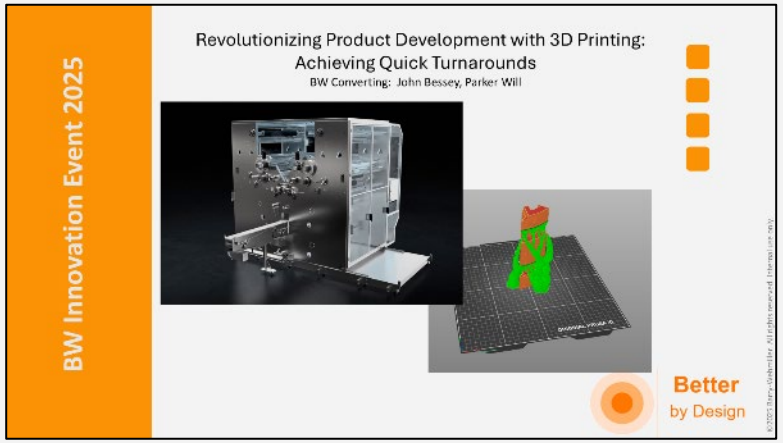
BWP – STU

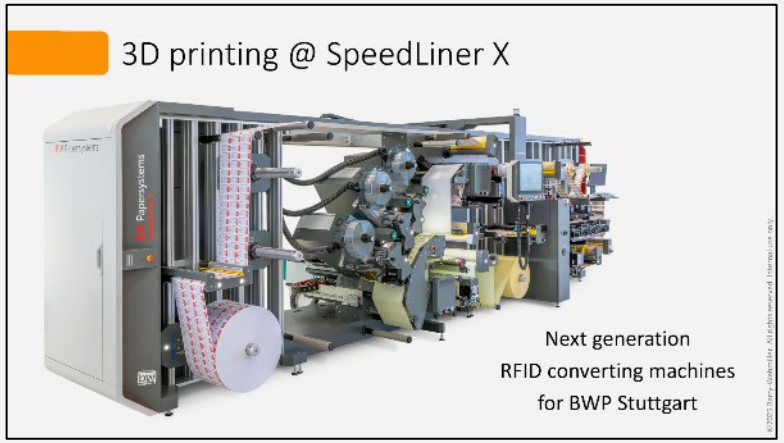
Christian Berger
3D Printing Engineer

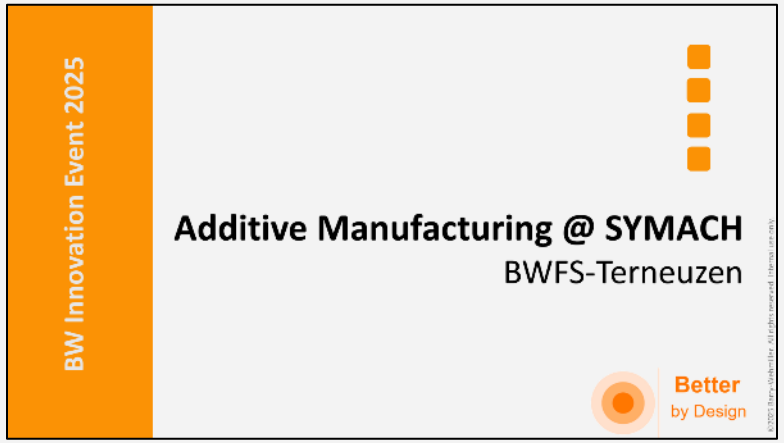
BWP - STU

External Provider for 'alternate' technology

Peter Klaassen
Mechanical Engineering Leader
BWFS - TER







BW Innovation Event 2025

Additive Manufacturing @ SYMACH

BWFS-Terneuzen

Better by Design

History and materials

- We use 3-D printed parts since 2018
- Started with small parts, easy to replace
- Last year: 180 unique part numbers → Total 2.800 parts, Eur 39.500

Primary Materials:

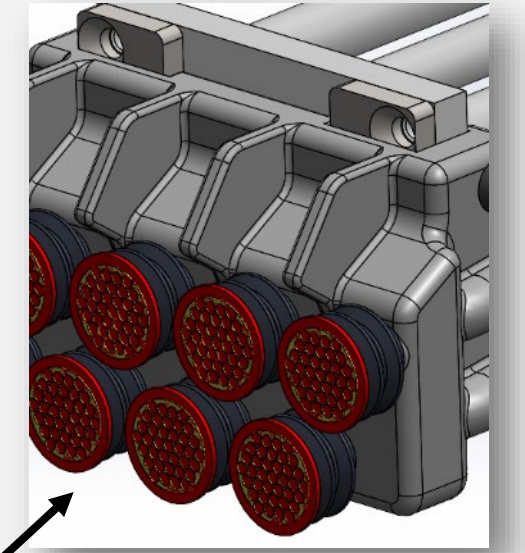
- PA12
- TPU (flexible)
- PA12 Food Approved

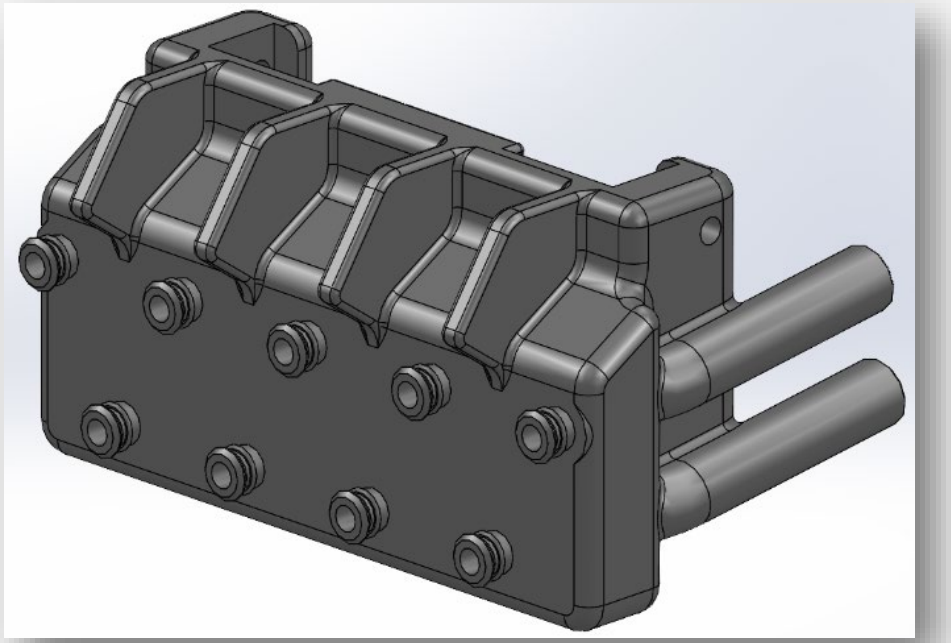
Primary Reasons for using Additive Manufacturing:

- Time savings
- Cost savings
- Design for function and for specific application requirements

Examples with PA12

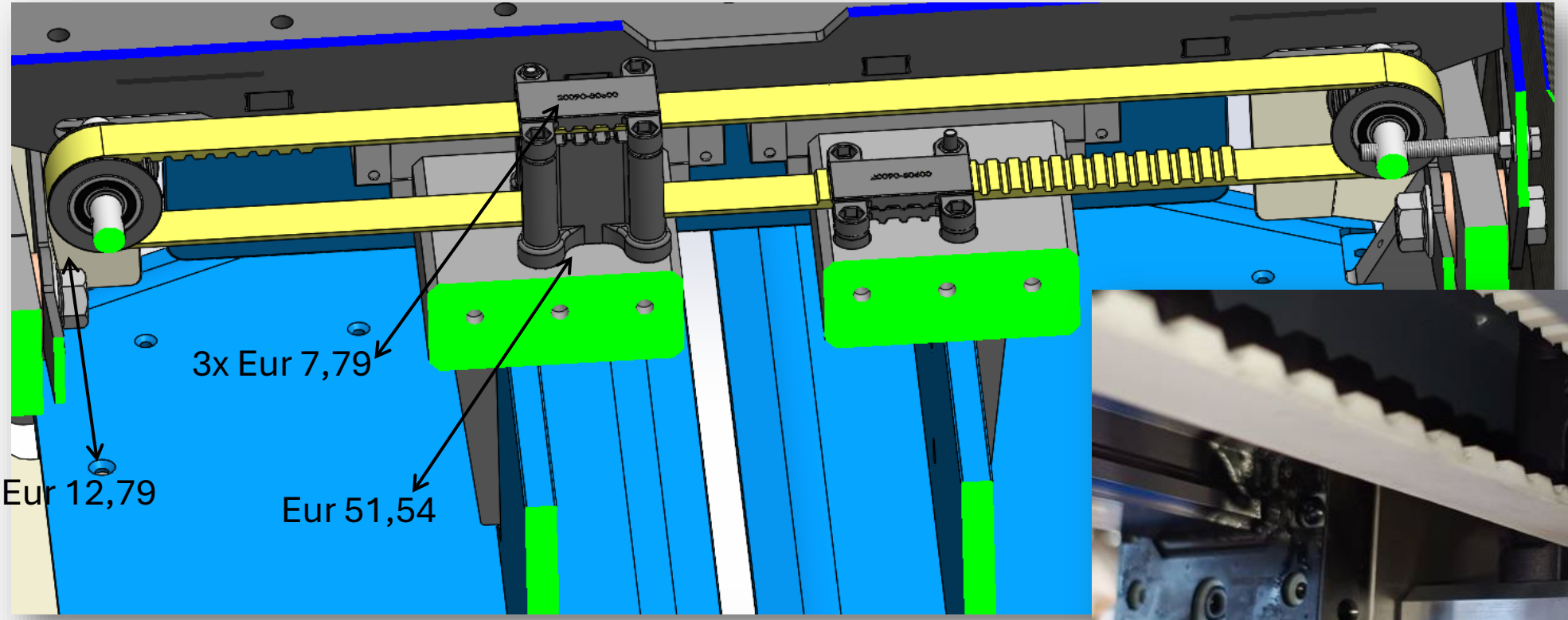
- Suction cup base in FillStar to open the bag at the spout
- Base for multiple cups not standard available
- Eur 74,02





Examples with PA12

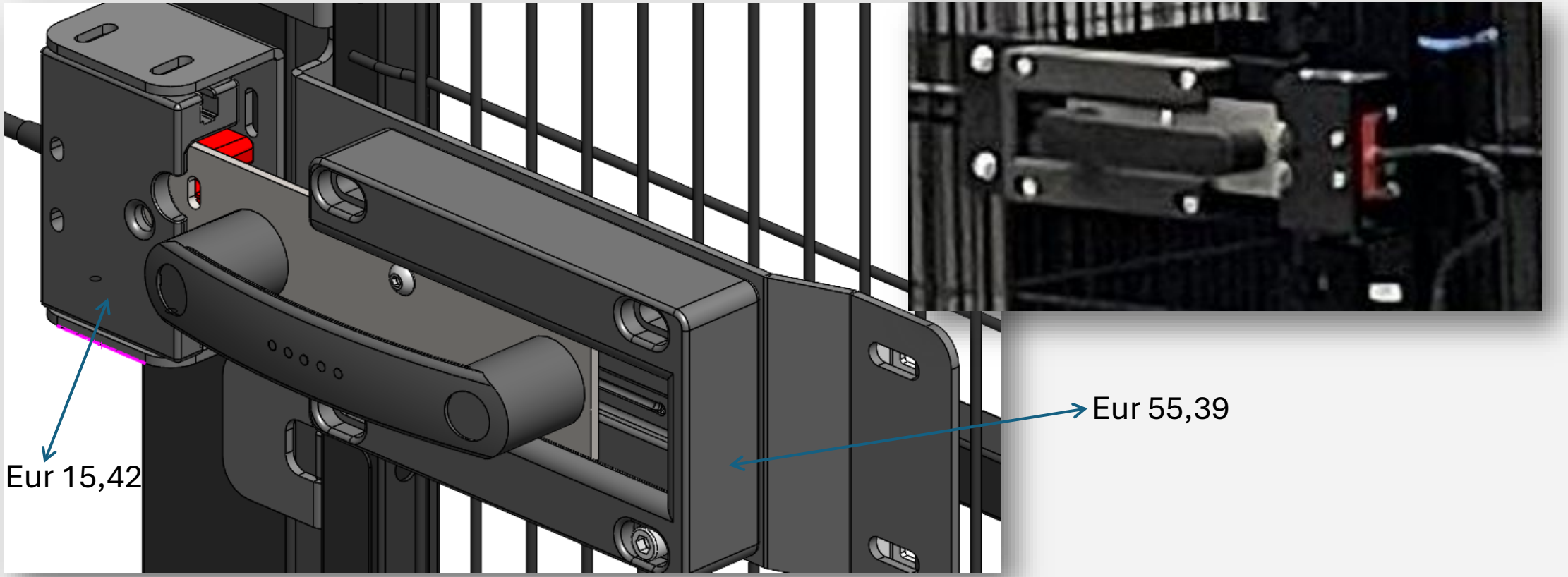
- Toothed belt to synchronize centrating plates
- All fasteners to be mounted from below – reduces assembly time



Allows design for function – nut holder in upper part / passing belt through left lower part.
Provides the lowest-cost solution.

Integrated application in safety door

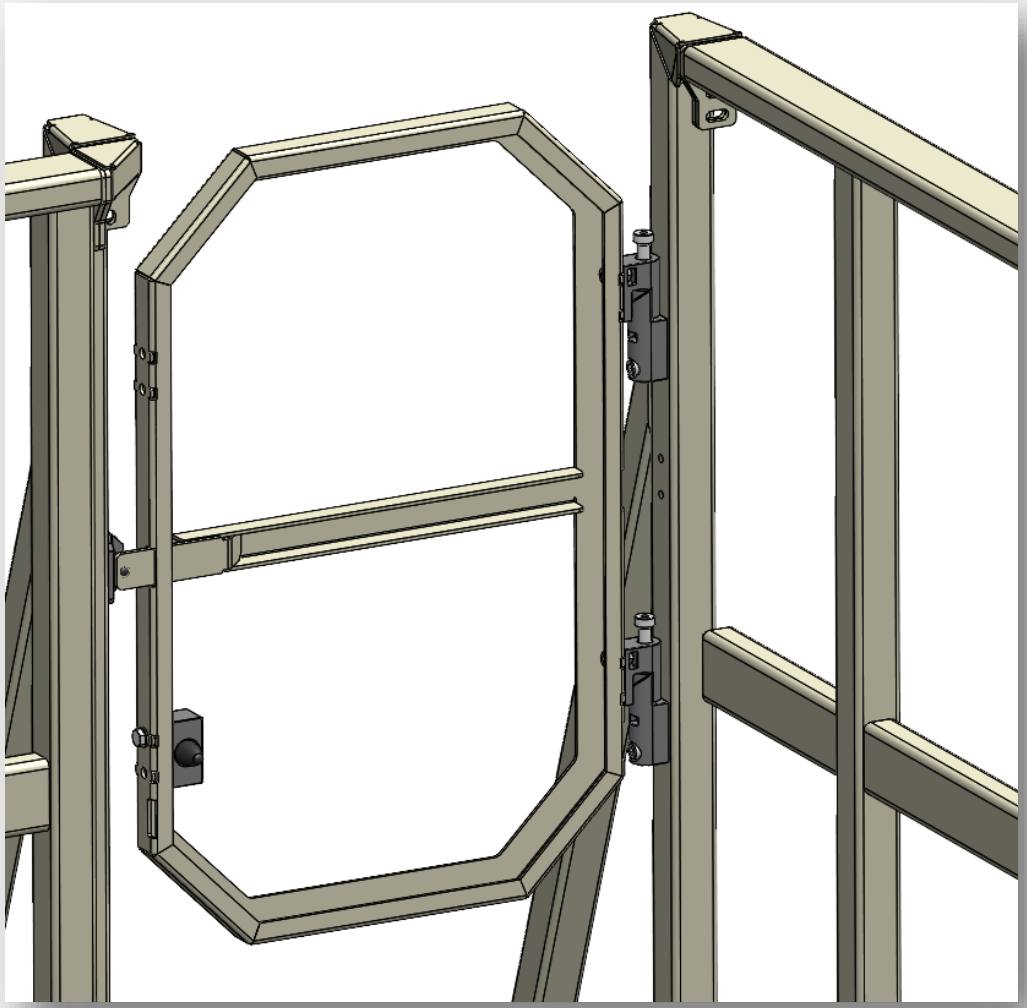
- Combined parts to assemble safety sensor – reduced part count
- All separate parts are adjustable

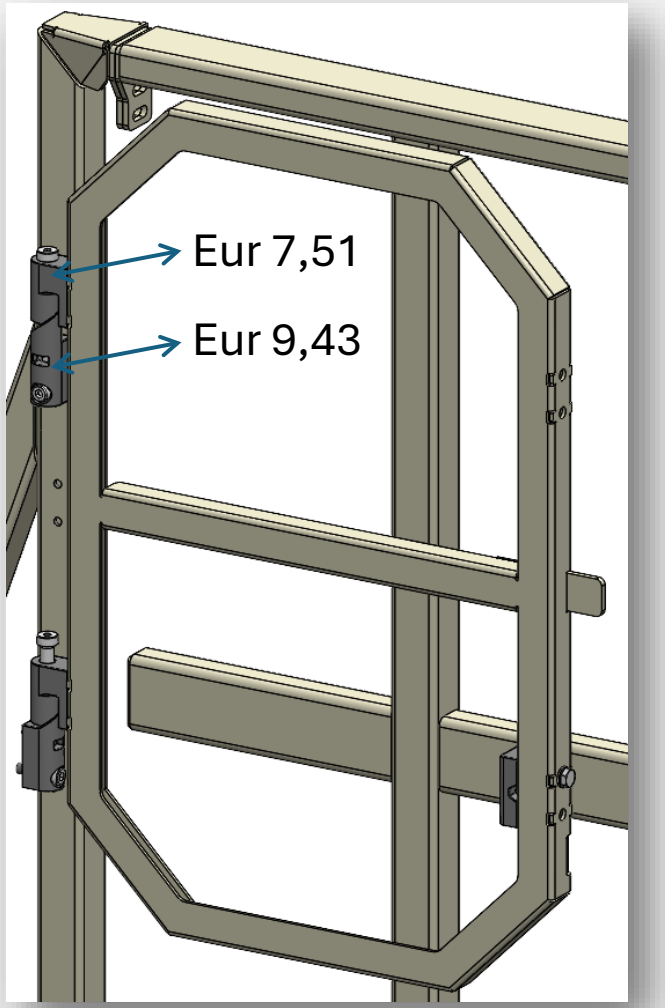


Additive provides the ideal solution to accommodate a range of sensor brands

Example of Combined Parts

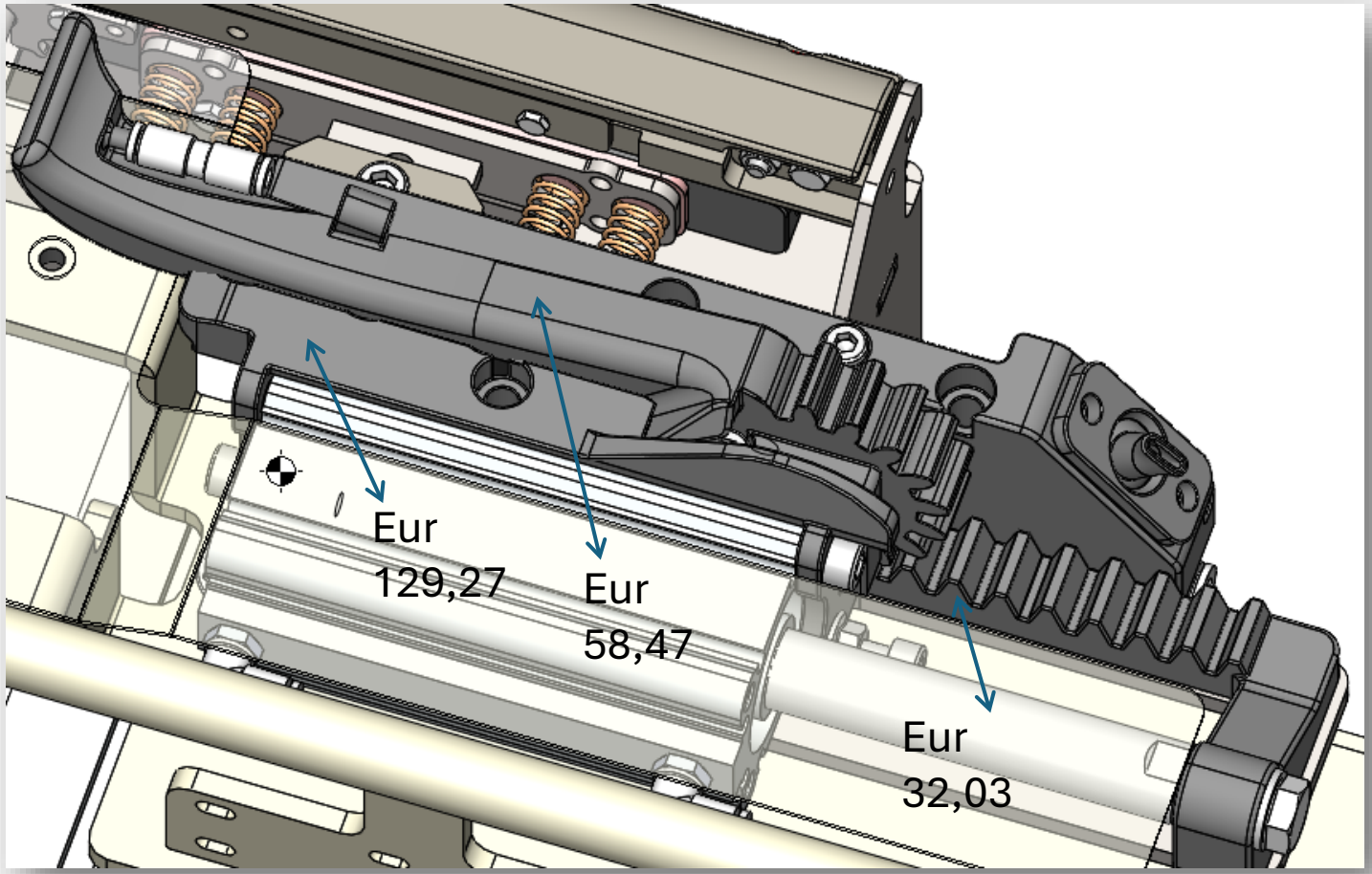
- Self-closing hinge at platform door





Foil clamp in wrapping machine

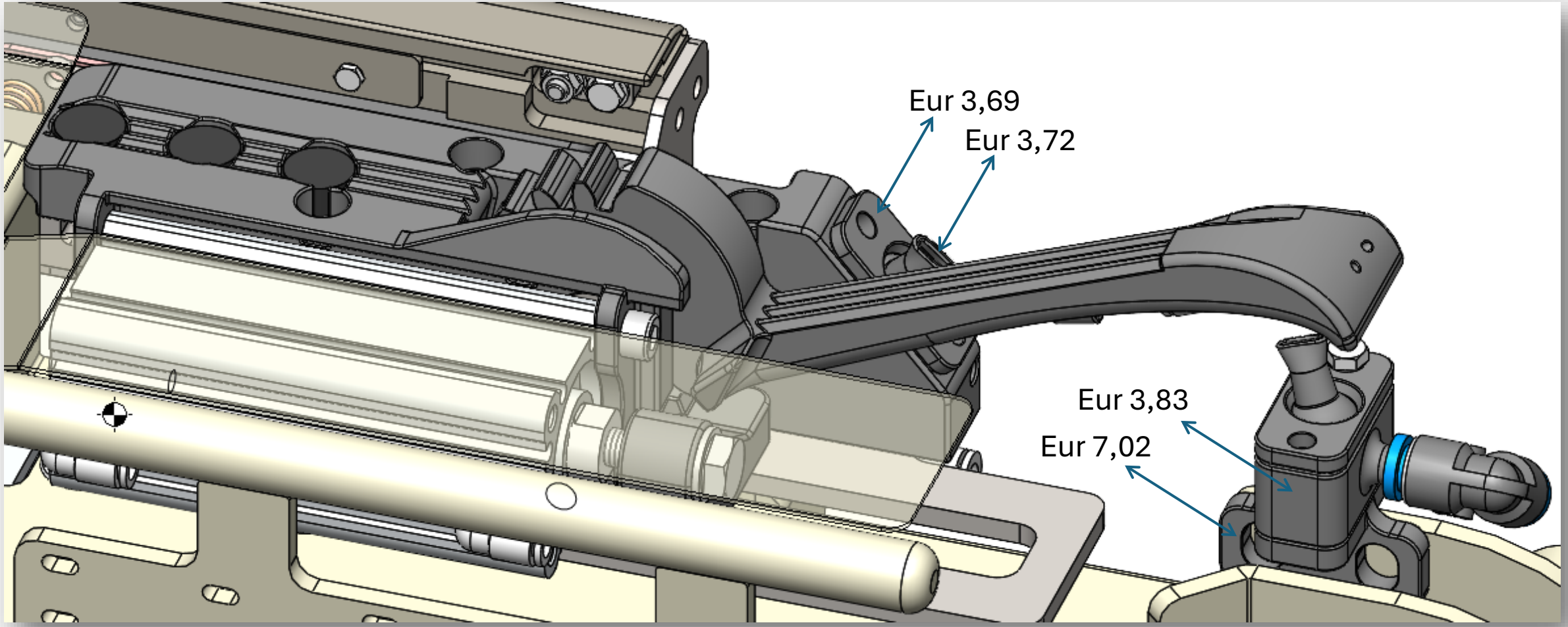
- Rack and pinion



Improved performance provided by the design freedom and easy iteration of AM

Foil clamp in wrapping machine

- Air nozzles



Recap

- AM continues to show its value across the enterprise
  - Solve design challenges – evaluate & iterate quicker than ever
  - Save time & money, free working capital, add supply chain resilience
- Let us Help → Training & Support is available
  - The AM Team is ready and eager to help!
  - Virtual, in-person, hands-on – a wide range of options
- The AM Centers exist to provide high quality at lowest cost
- Implementing AM has never been easier!

Additivemanufacturing@barry-wehmiller.com

Better
by Design

Thank You!