



TRUMPF



Laserapplikationen im Leichtbau

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Industry Management & Business Development Mobility

Agenda

01 Market requirements

02 Innovative 3D laser cutting for PHS components

03 Integration of big AI HPDC modules

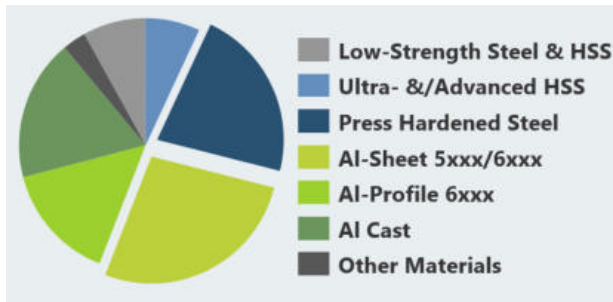
04 Laserwelding of Cast Aluminium

05 Laser processing of FRP

Automotive Industry

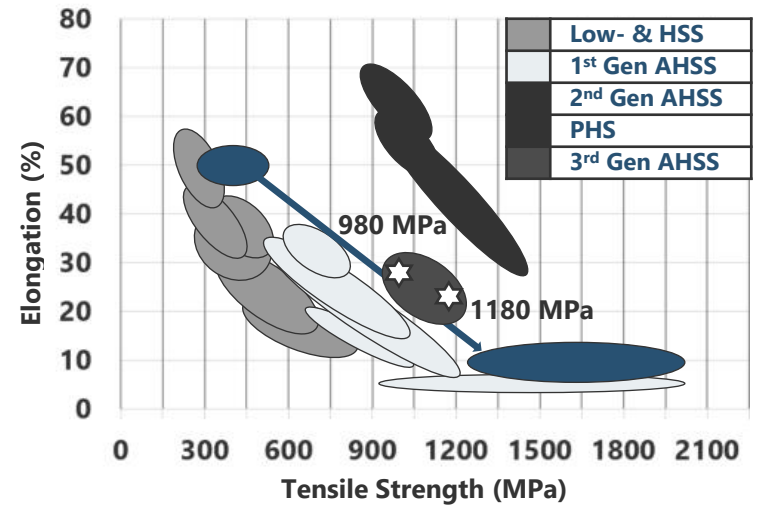
Major market for laser applications at light weight design

BEV material mix



High Strength Steels

- Increased application of PHS
- Reduction of low- and high strengths steels
- New Gen3 steel grades: specific alternative but no PHS replacement



Aluminum

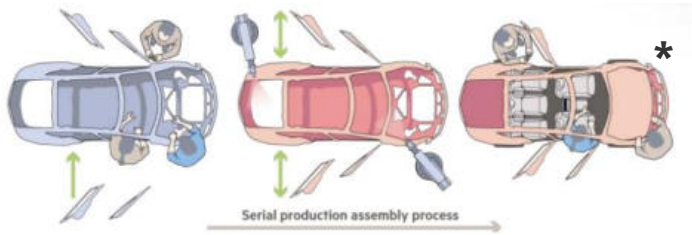
- More Al-sheet application at hang-on parts and battery pack
- Increased application of hot formed Al6xxx alloys in structure
- Integration of big Al high pressure die cast parts (HPDC)



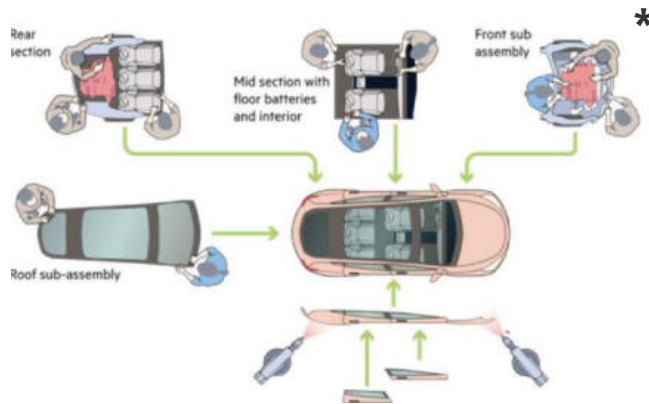
Future production strategies lead

Cost and time reduction as main focus

Traditional assembly



New approach: Unboxing



• = SOURCE: Financial Times web article:
<https://www.ft.com/content/08048b42-ce72-4b64-9e0e-d15fbc98a9da>

Key target is reduction of:

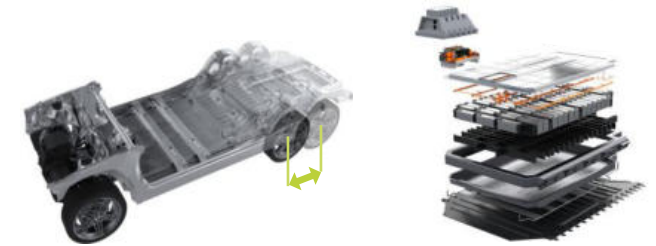
Material

Parts

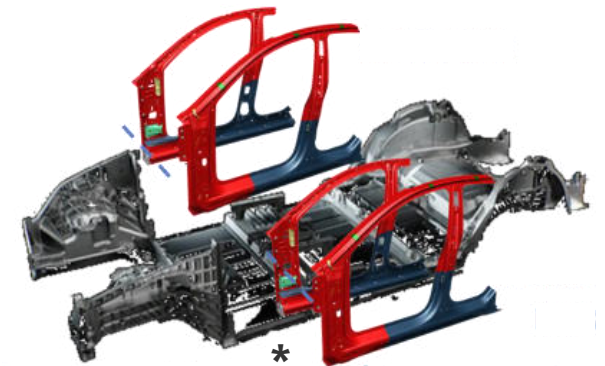
Complexity

Assembly steps

Platform strategies



Parts integration in Aluminum and steel
Module delivery to assembly line



• = SOURCE: Gestamp, www.gestamp.com

Giga Stampings/Giga Casts

Carbody design development trends

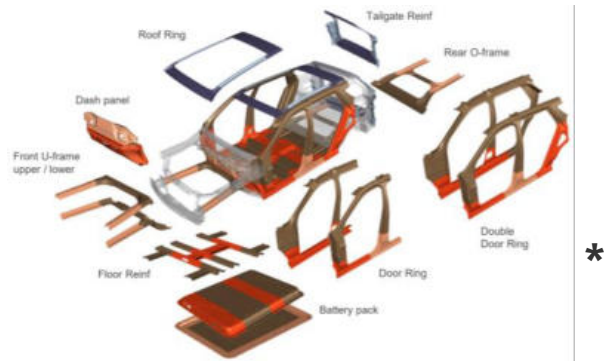
Multiple part integration to one piece

Steel: First parts presented 10 years ago

Doorings at SUVs in North America



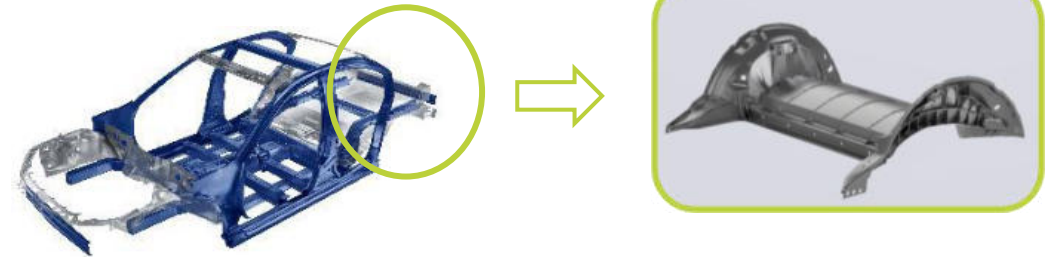
- Now Double Dooring Integration of 8 Parts into one
- More "Giga-stampings" to come:



* = Source: ArcelorMittal MPI concept

Big Aluminum high pressure die cast parts: Trend since 2020

Example Rear wagon:



Standard steel rear body

80 Stamping parts
30 process steps
Cycle time: 45 min

Big Alu HPDC rear body

=> 1 casted part
=> 1 process step
=> Cycle time: 90-120 sec

Current Alu HPDC challenges: Alloy composition & Repair concept

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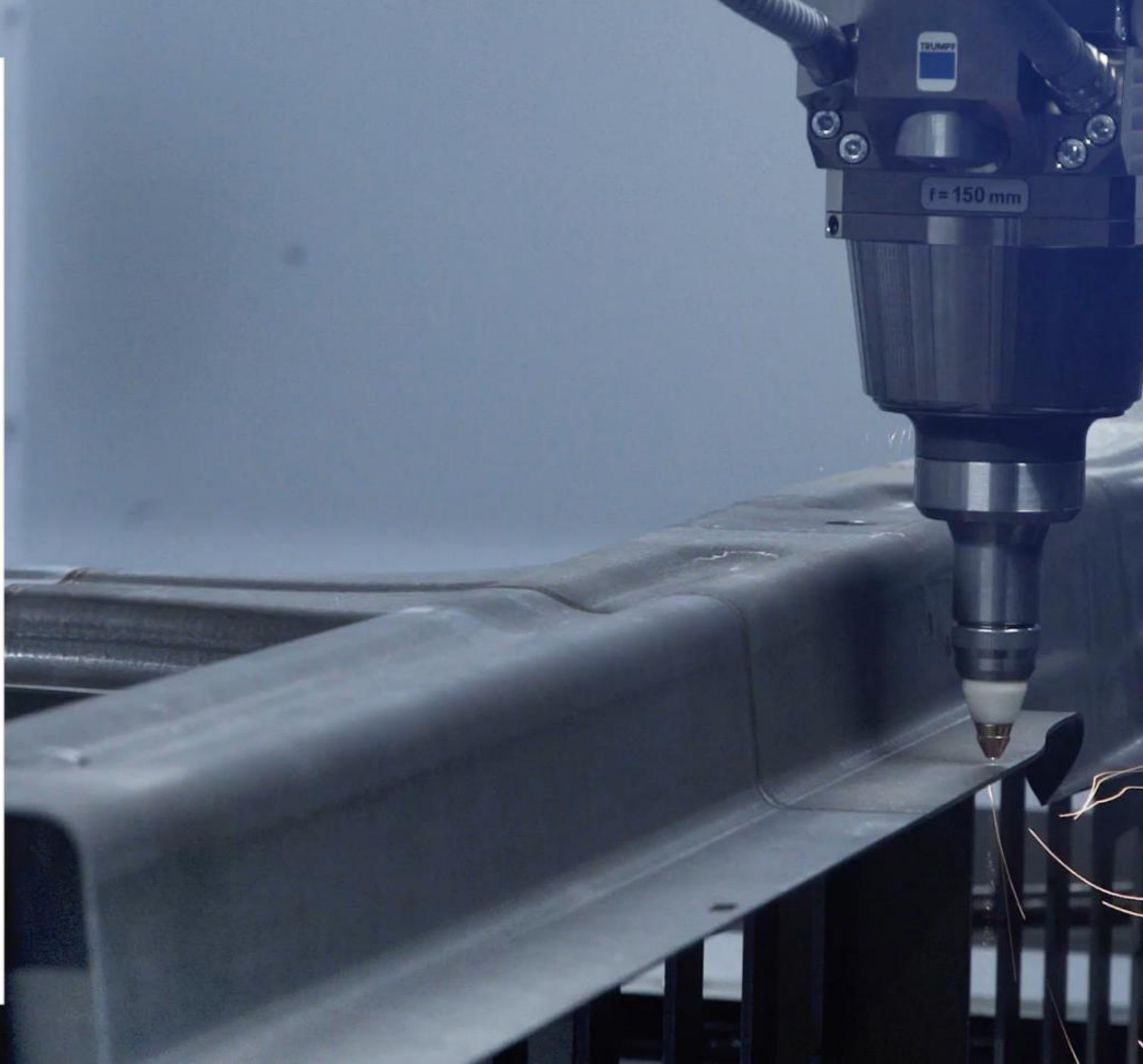
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TruLaser Cell 8030

Cutting of integrated
structural parts



TruLaser Cell 8030

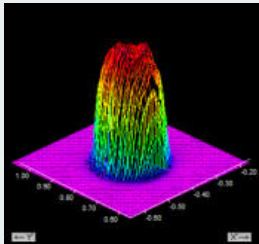
State of the art – and – BrightLine Speed

Status Quo



Single core fiber

TruDisk 3001



TruDisk 3001:

First choice due to ratio between investment, performance, robustness and energy consumption since 2021

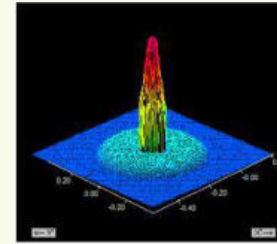
BrightLine Speed



TruDisk 3000

Adjustable core switch

2-in-1 fiber



Optimized beam profile

- + 60% higher cutting speed
- + 50% less gas consumption
- + 20% more robust processes

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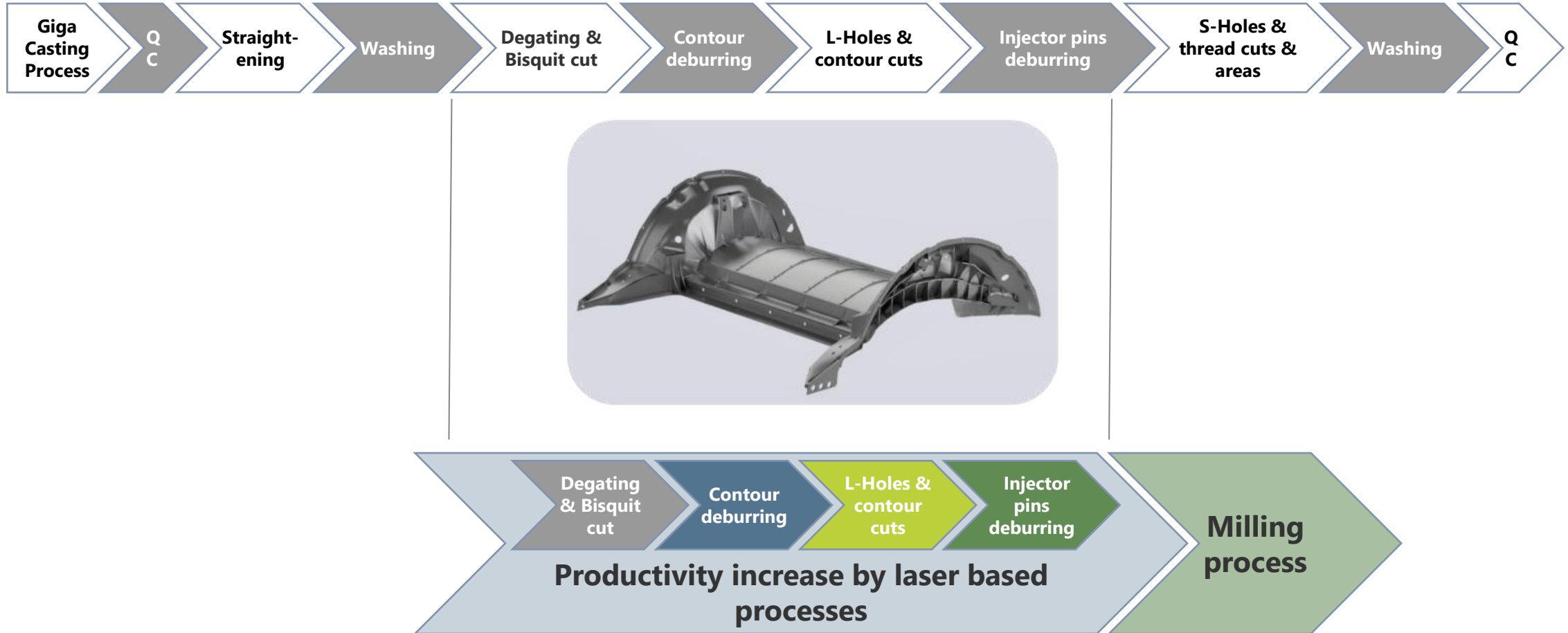
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HPDC post process

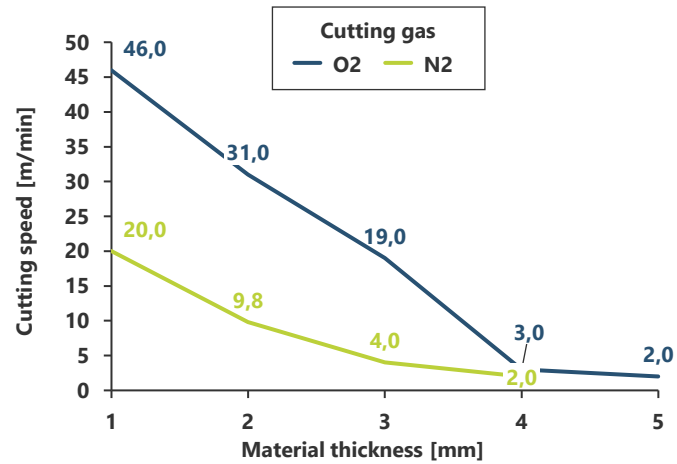
Main current focus on 3-D laser cutting



5-Axis laser cutting solutions

Highest cutting speeds at best reliability

- Laser ensures highest cutting speeds: AlMg3 cutting with TruDisk 4001



- 5 Axis laser cutting system TruLaser Cell 7040 provides highest accuracy, reliability and speed

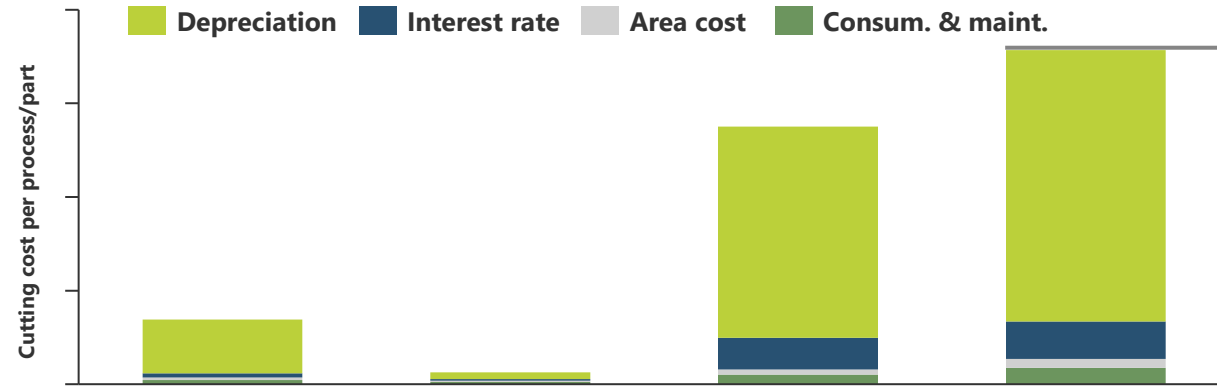


Conventional cutting vs. laser process

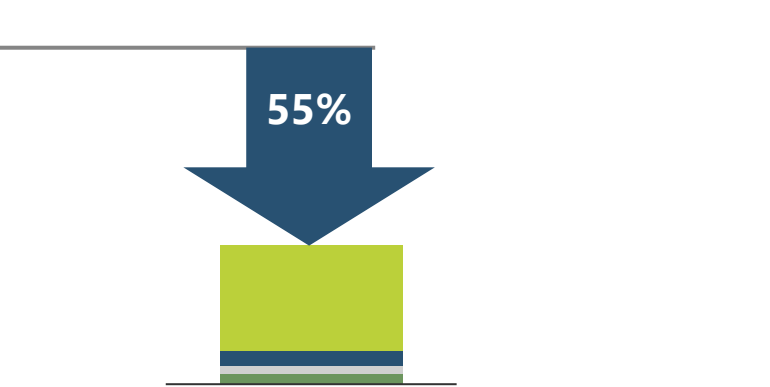
Up to 55% part cost reduction possible

180.000
AI- HPDC
parts/Year

Conventional cutting processes



TruLaserCell 7040 solution



	Press Brake system	Plasma cutting with 2 Robots	Milling center	Total Cost
	Degating & Bisquit cut	Contour deburring	L-Holes & contour cuts	
# of systems	2	1	4	

TRUMPF TruLaser Cell 7040 with TruDisk 4001	
Degating & Bisquit cut	Contour deburring
L-Holes & contour cuts	
6	

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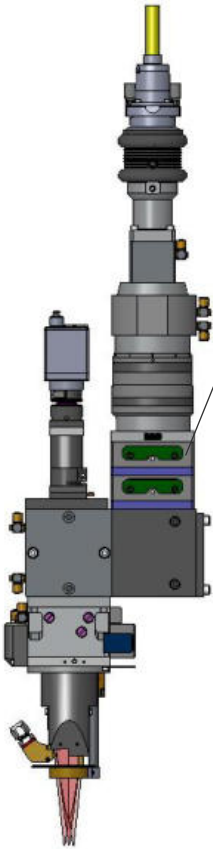
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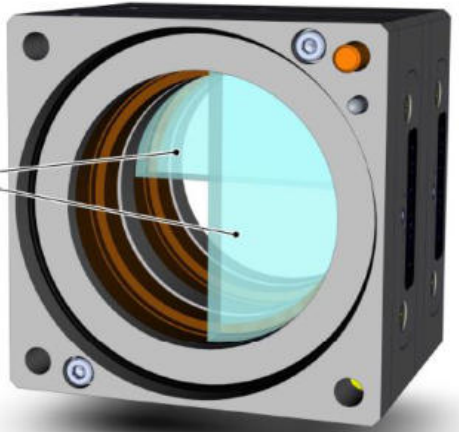
TRUMPF Multifocus Technology

Enables leak tight Cast Aluminium welding

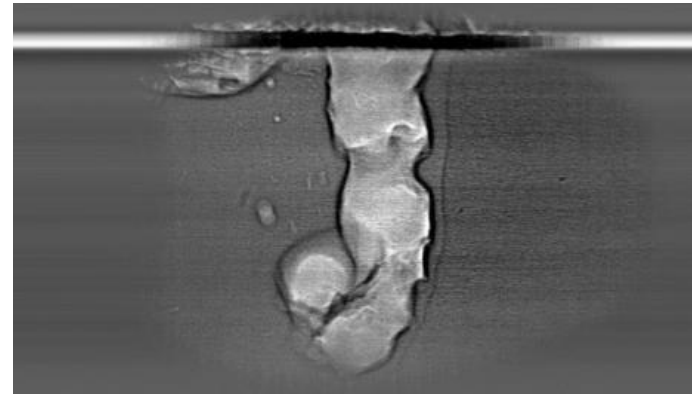
Optics



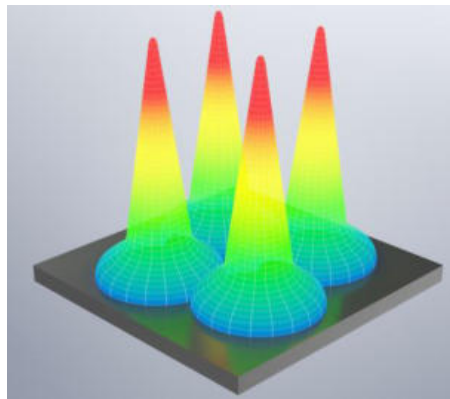
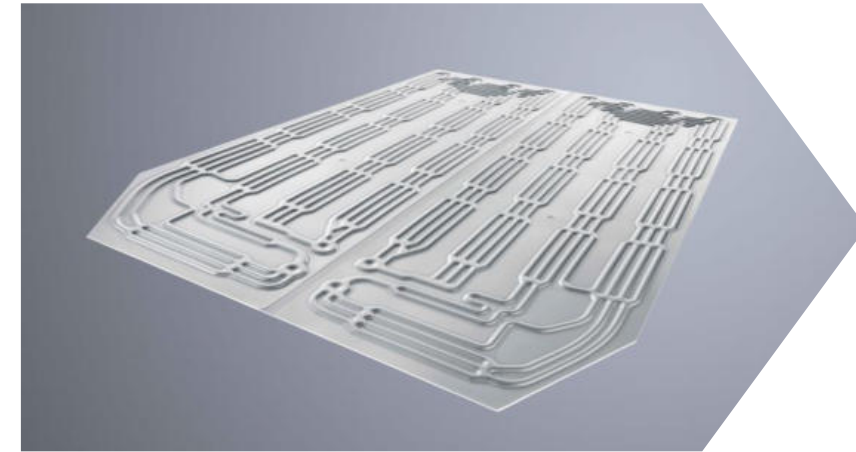
Base Module



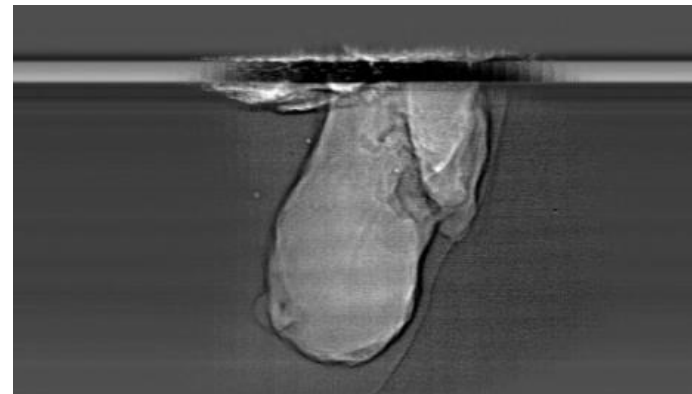
Process Development
at DESY Synchrotron



Cooling Plate Assembly



Beam Profile

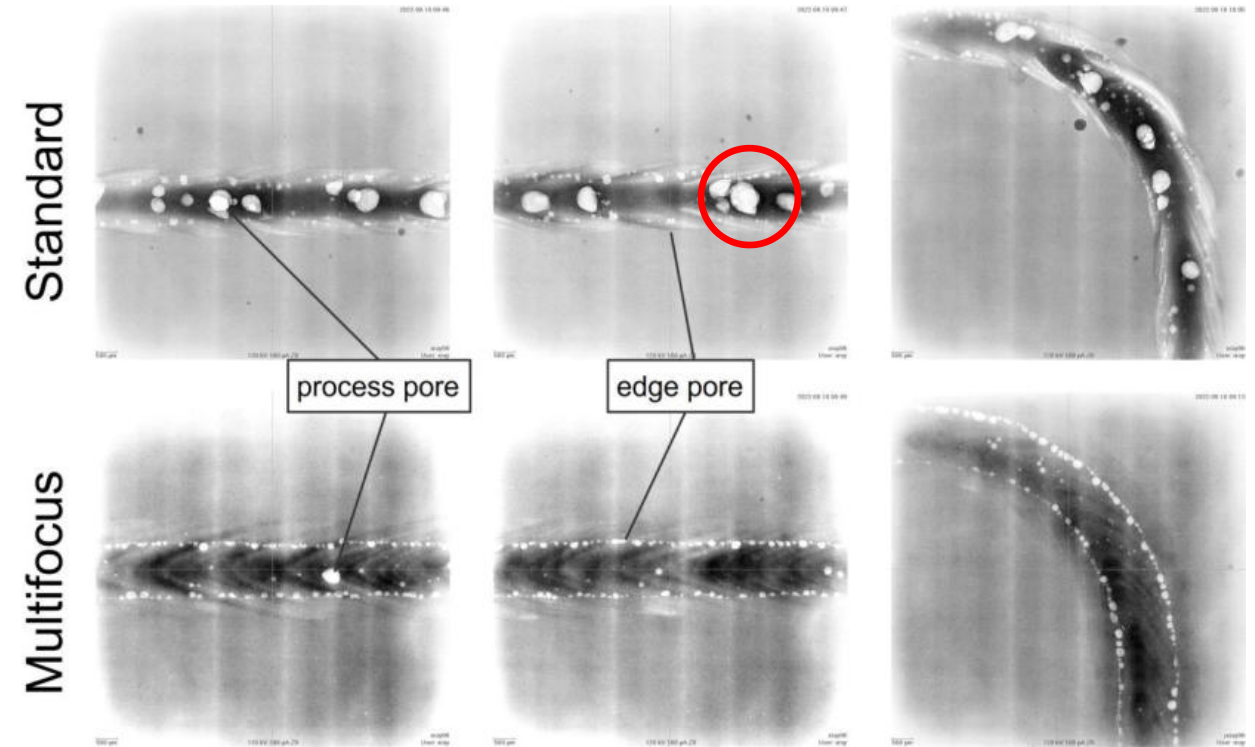
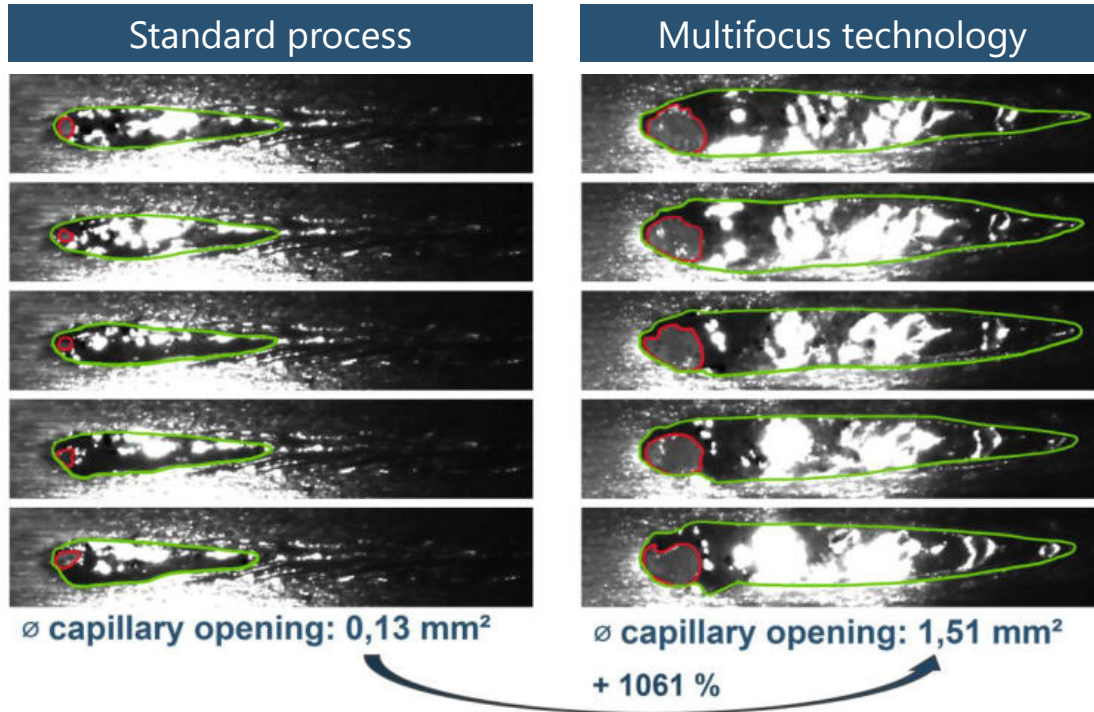


Power Electronics Housings



TRUMPF Multifocus Technology

Enables leak tight Cast Aluminium welding



Calculation of pore surface

- Standard process: 14,5%
 - Multifocus technology: 1,1%
- Reduction by 92%

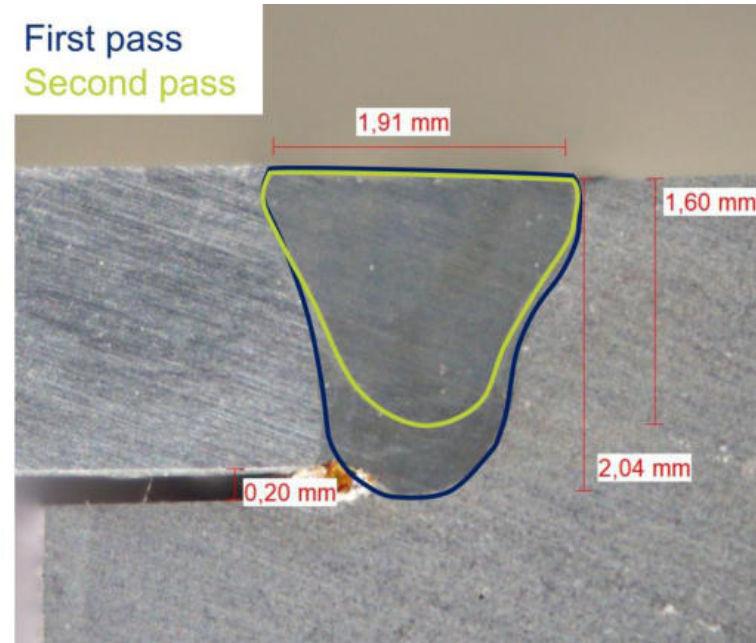
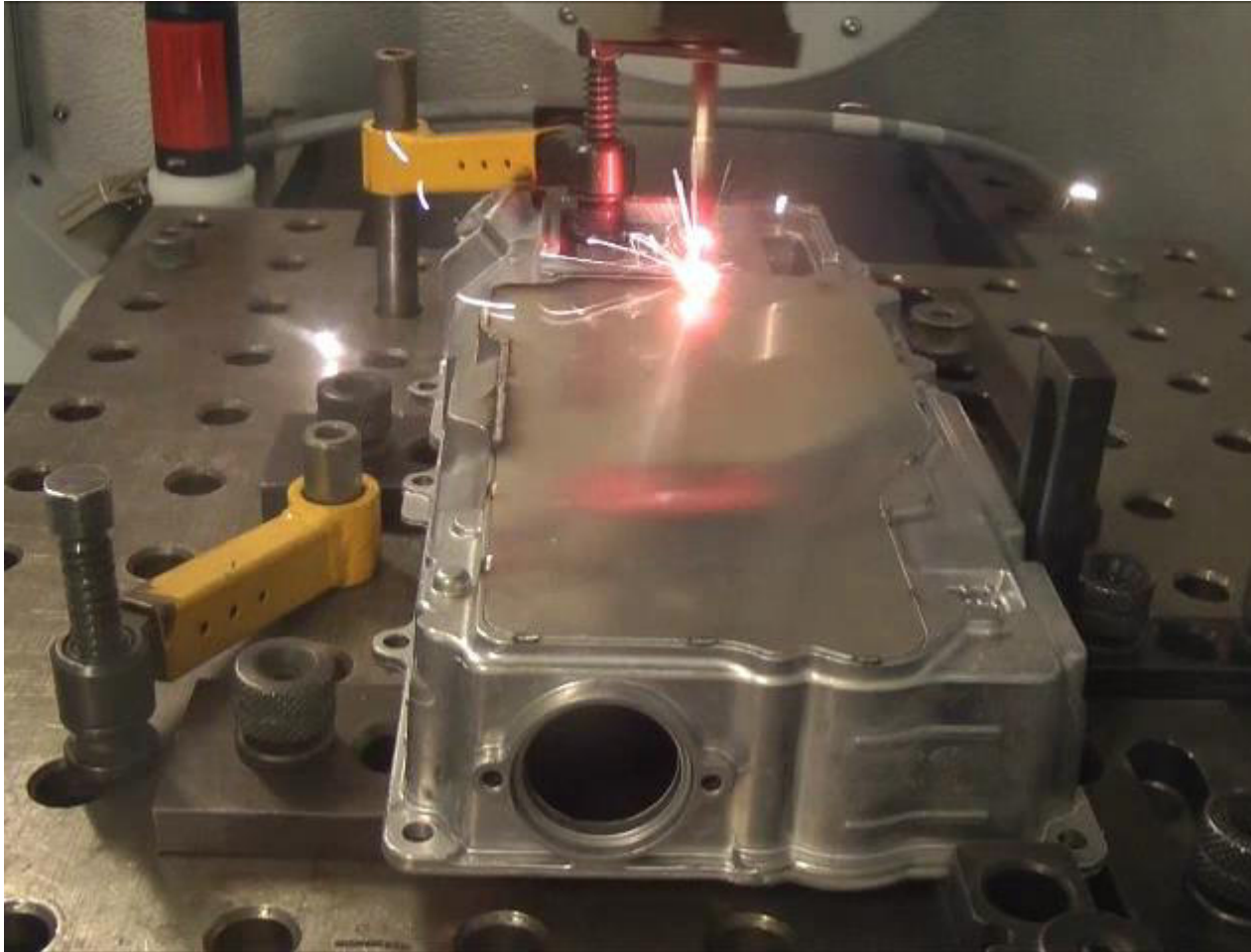
Largest pore standard process



- 0,78 mm → seam width 1,2 mm
- Reduction of tight surface by 65%

TRUMPF Multifocus Technology

Enables leak tight Cast Aluminium welding



PASSED

Pressurized air test¹ and Helium leakage test²

¹Duration: 30 s, Pressure: 1 bar; Limit pressure drop: 40 Pa

²Pressure: 600 mbar; Sniffing probe

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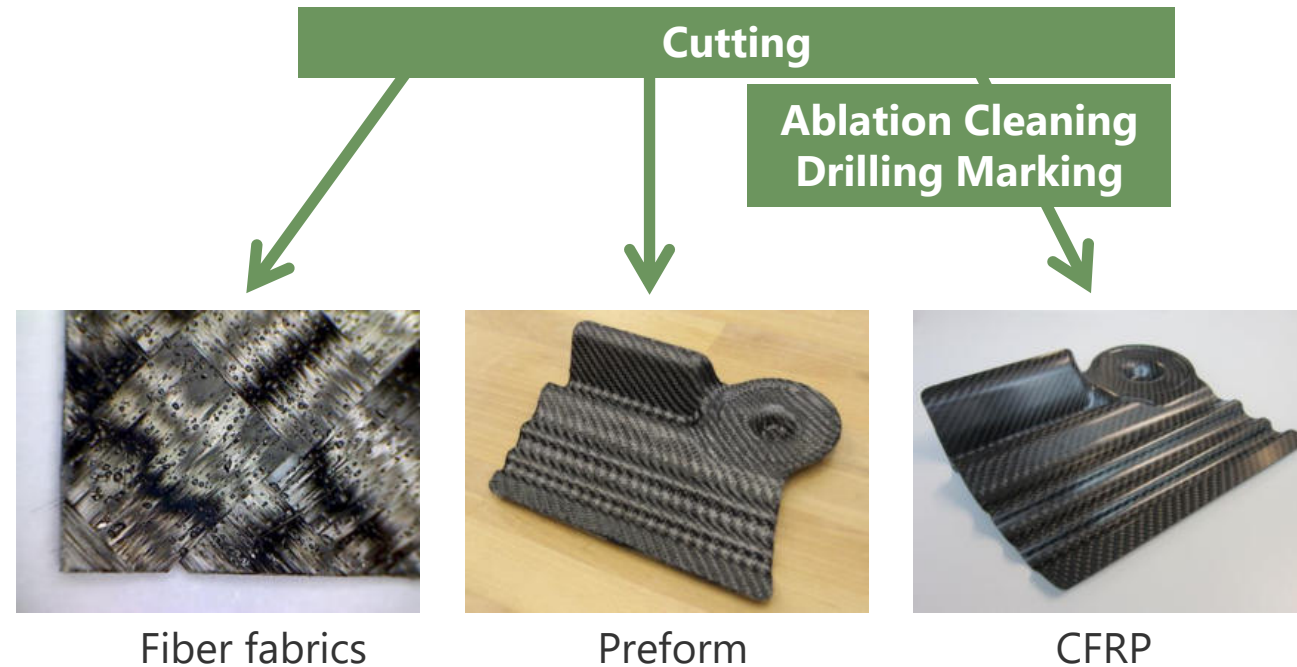
CFRP production process and laser application

Universal tool for different requirements

- CFRP production process: From base material to final product

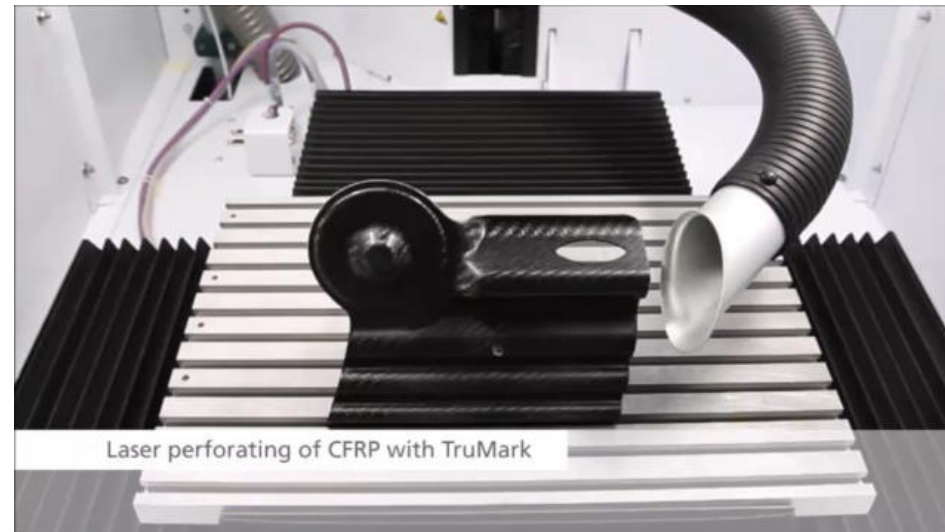
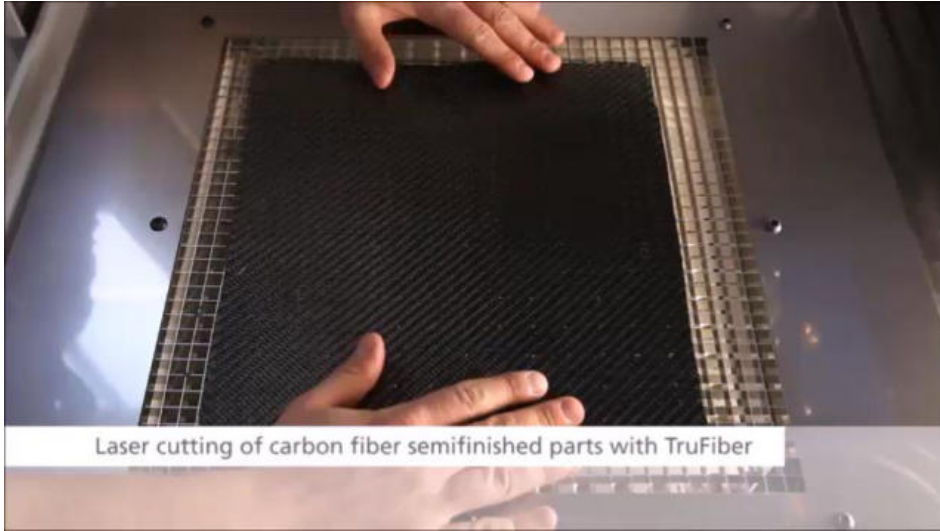


- Laser processes



CFRP production process and laser application

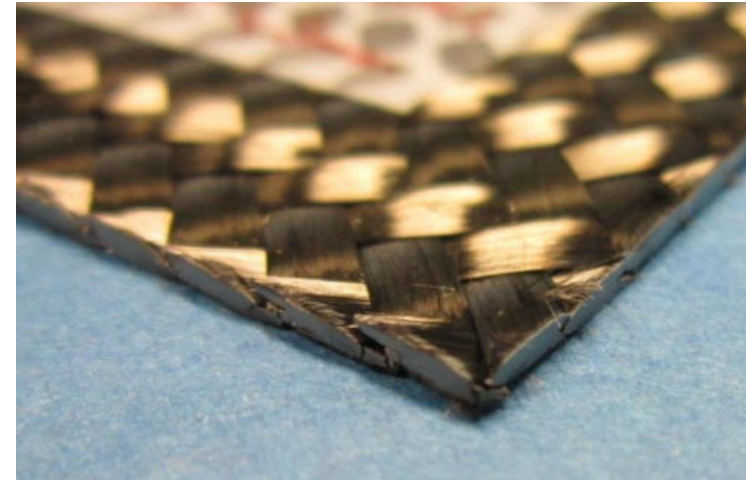
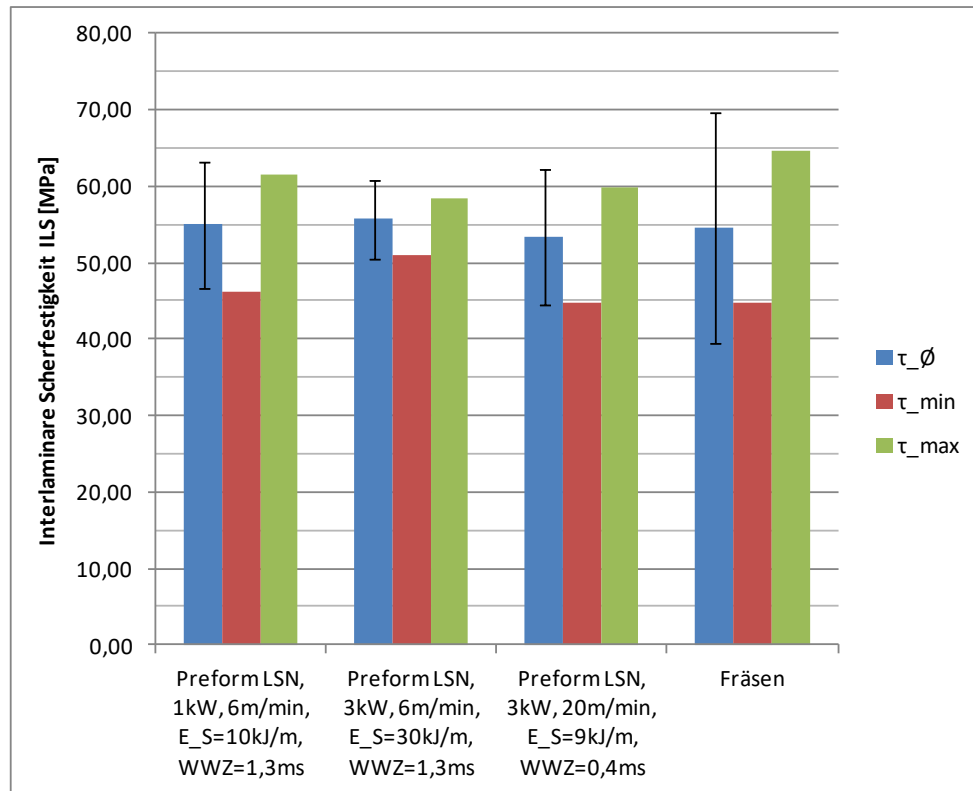
Youtube: <https://www.youtube.com/watch?v=5o7XjJkRB1k>



Cutting of preforms

Influence on interlaminar shear strength (ILS)

- Laser cutting to final contour has no influence on ILS (DIN EN 2563)



- Laser cut CF-preforms ensures same ILS compared to milling

Summary

- Aluminum is the main material for lightweight design, but steel will continue to play an important role in the future.
- Press-hardened steel is the most efficient way to achieve lightweight design with the best possible crash performance and laser beam cutting is the key to body integration.
- Large aluminum high pressure die castings will play a key role in lightweight design and cost reduction. Standard 5-axis 3D laser cutting systems offer up to 55% cost savings in post-processing compared to other technologies.
- Fiber-reinforced plastics currently play a smaller role in automotive lightweighting, but in the case of increased application, the laser has proven to be a very effective tool in the production process.



TRUMPF



Many thanks

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