



WORKSHOP

Lavorazioni laser nel settore e-mobility: stato dell'arte e prospettive future



Soluzioni LASER avanzate per la saldatura nel settore E-Mobility:

Applicazioni di sorgenti "blu"

Beam-shaping

Remote-welding



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA



18-11-2020

1

INDEX

Who is Optoprim

- Europe/Italy
- Supplier methodology
- Supported processes
- Application center

2

New opportunities for laser applications:

Blue and Hybrid laser solutions

- Copper problems
- Applications solved

Beam shaping

- Keyhole requirements
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Remote welding

- Position uncertainty
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3

4

5

Conclusions

- Our view

Distributor

- Established in 1994
- 75 employees in Europe
- Goal: Support integrators and end-costumers to better use laser technologies
- Goal: bring new opto-electronics technologies to industrial applications



2020

- 25 employees
- Italy turnover 2019: 20 M€
- Head quarter in Monza:
 - Commercial offices
 - Warehouse
 - Accounting
 - Backoffice
 - Application center
- Roma:
 - Commercial offices



1999

Corporate foundation

2009

Focus on high quality products

2011

Micro lab application center establishment

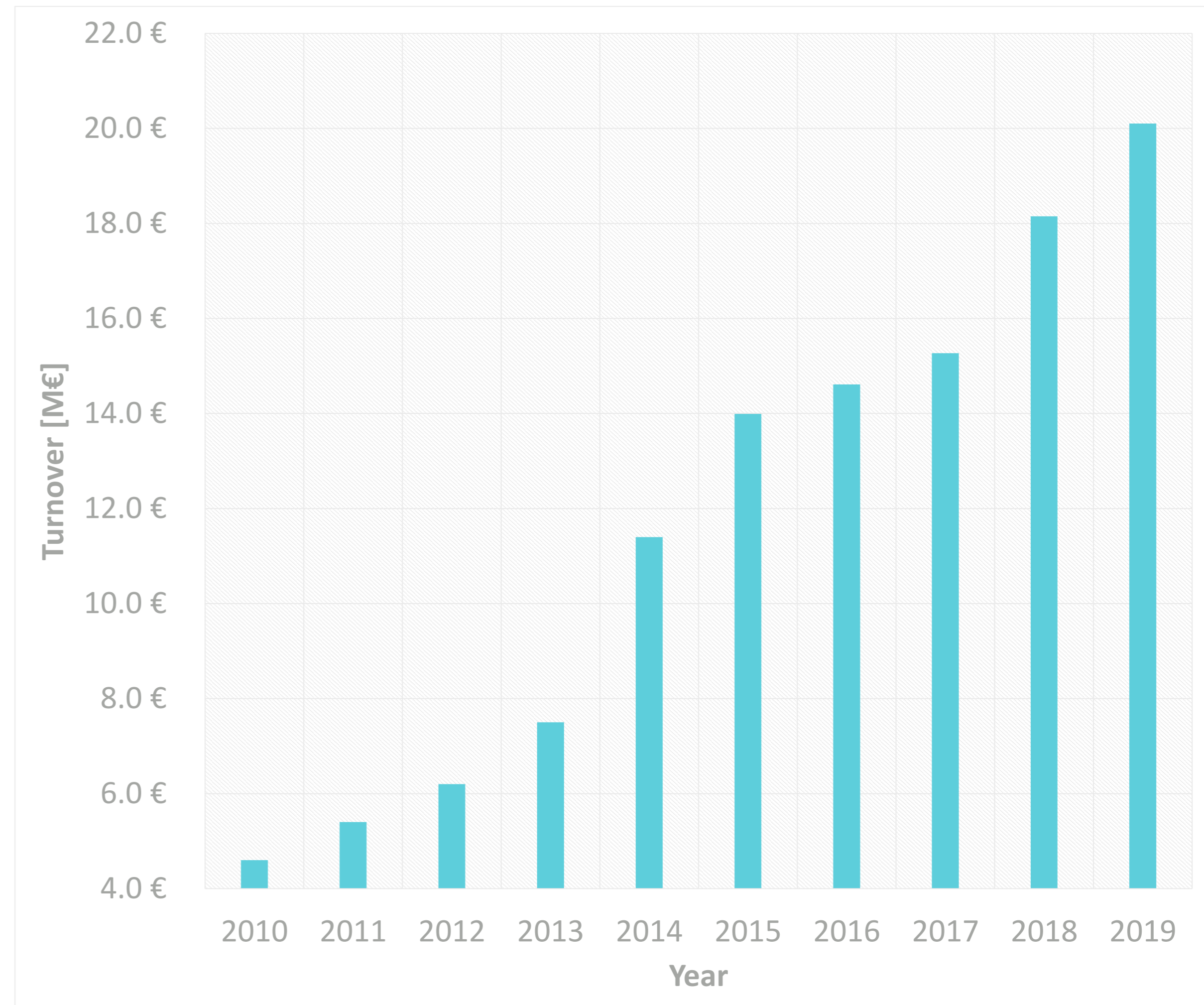
2016

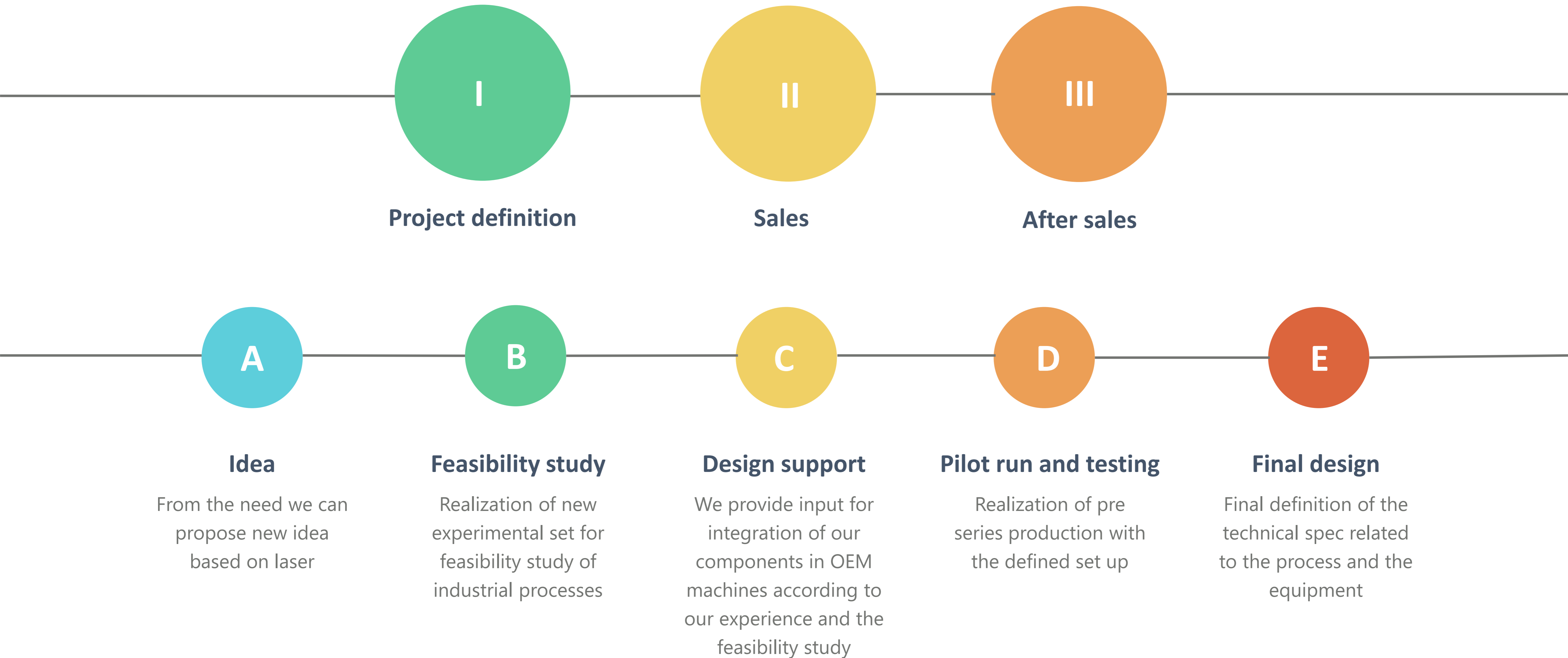
High power application center establishment

Italy

A new approach to the distribution

- Continuous investment in our application center: people/equipment >10% profit
- High know how in application cases
- Capability to support costumers in developing new processes: IP
- Industrial credibility
- Continuous acquisition of new technologies

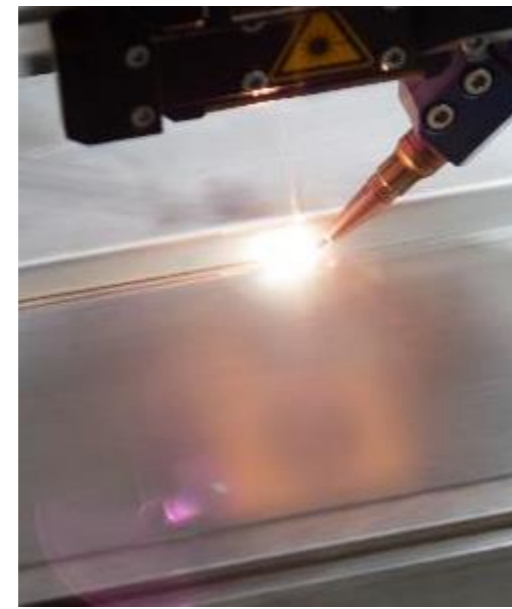




Who is Optoprim

Process supported

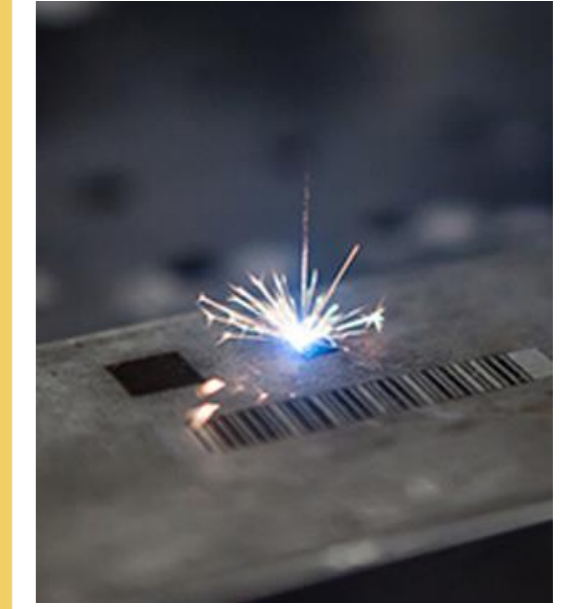
Brazing



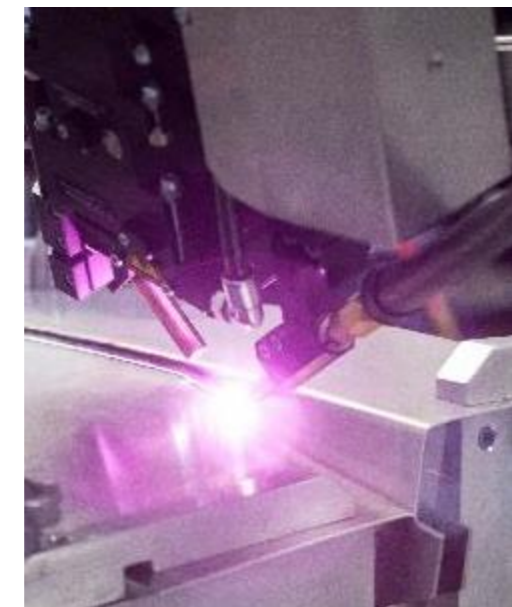
Cladding



Marking



Welding



Cutting

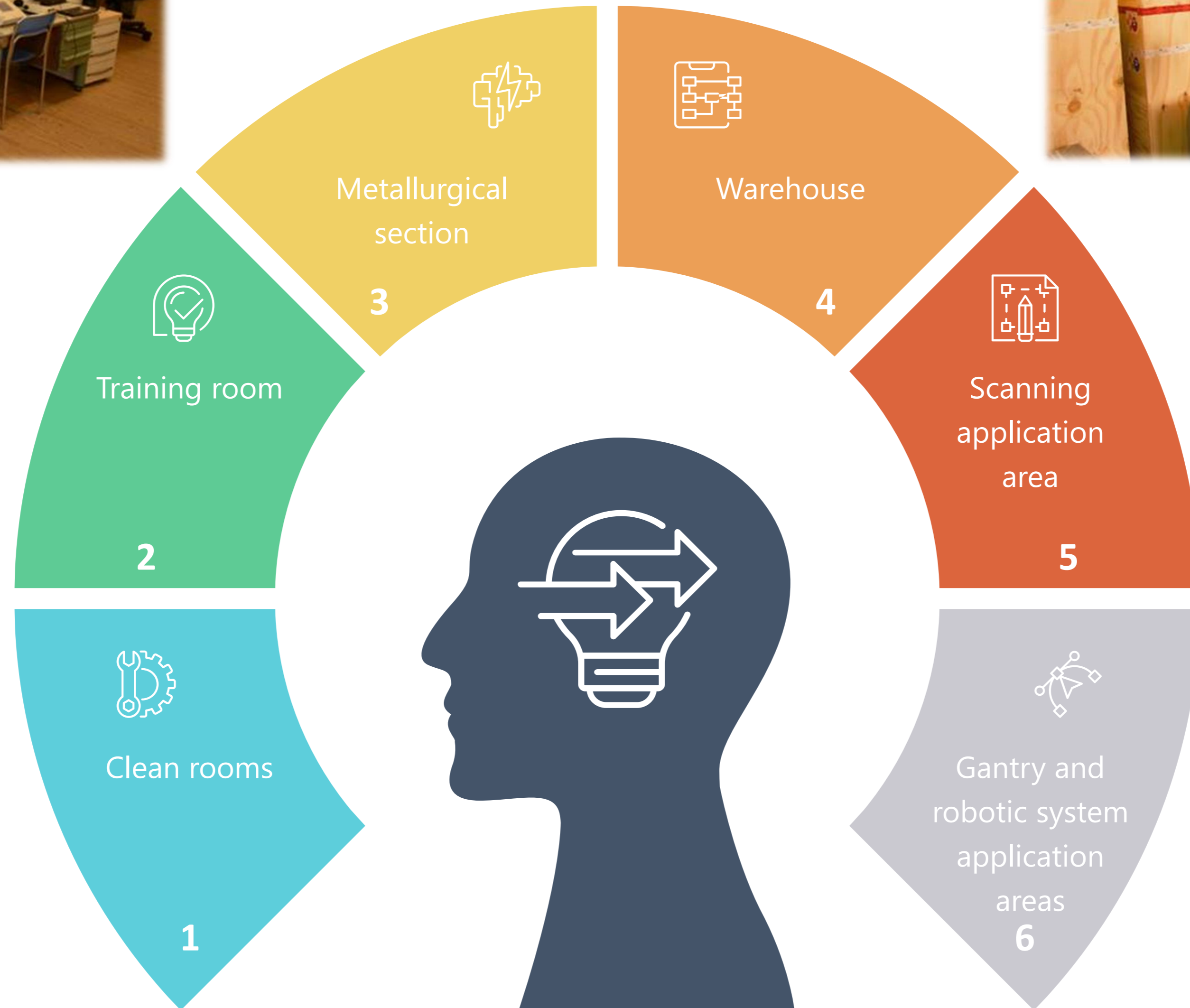


Heat treatment



Who is Optoprim

Our structure



Who is Optoprim

Our partners



1

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3

4

5

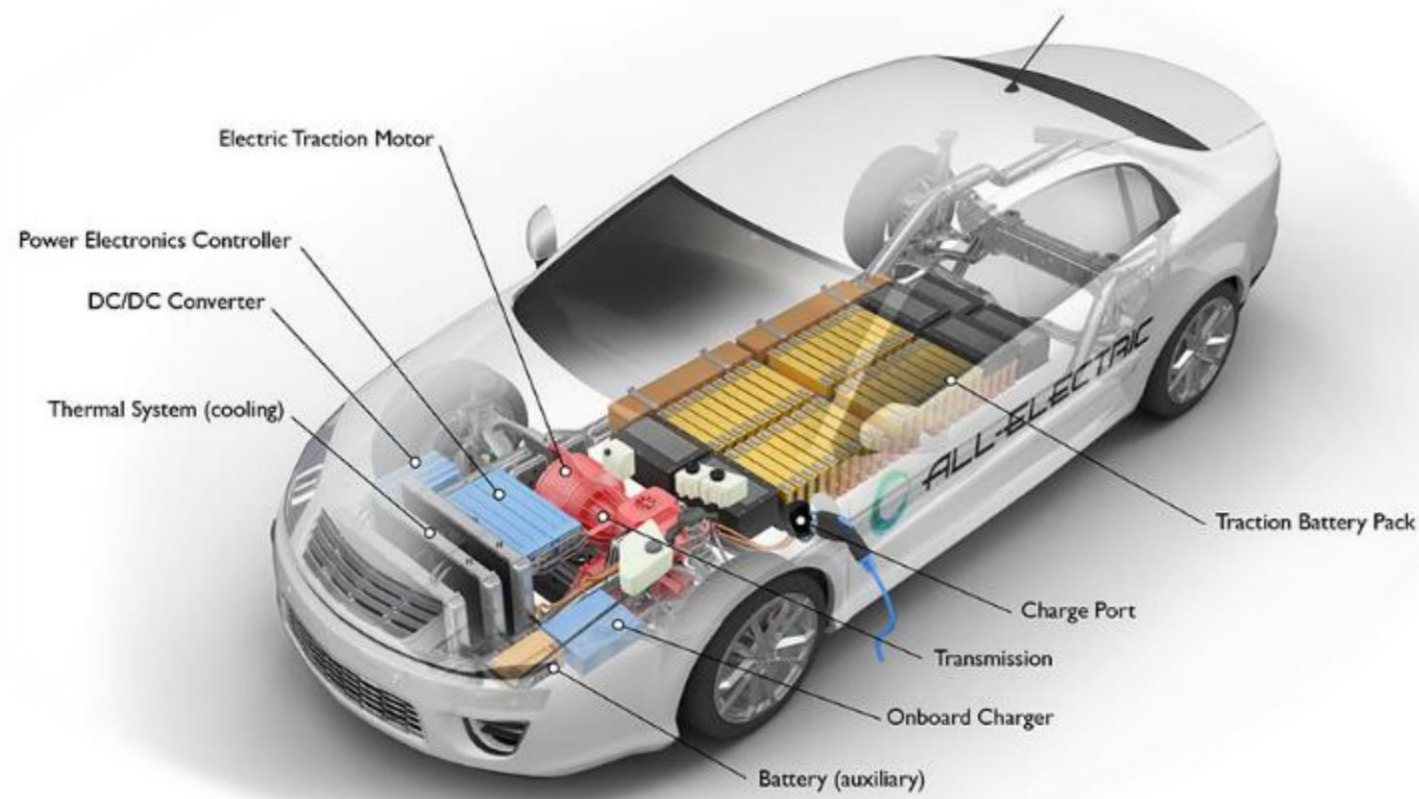
Conclusions

- Our view



New opportunity for laser applications

New available Laser processes in e-car



Battery welding



Tab Welding, Case battery welding

Stator welding



Hairpin welding, Hairpin cleaning

Transmission Welding



From the rotor to the crack-shaft

Plastic Marking/Welding



All plastic cases marking, plastic cases welding

INDEX

1

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4

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Conclusions

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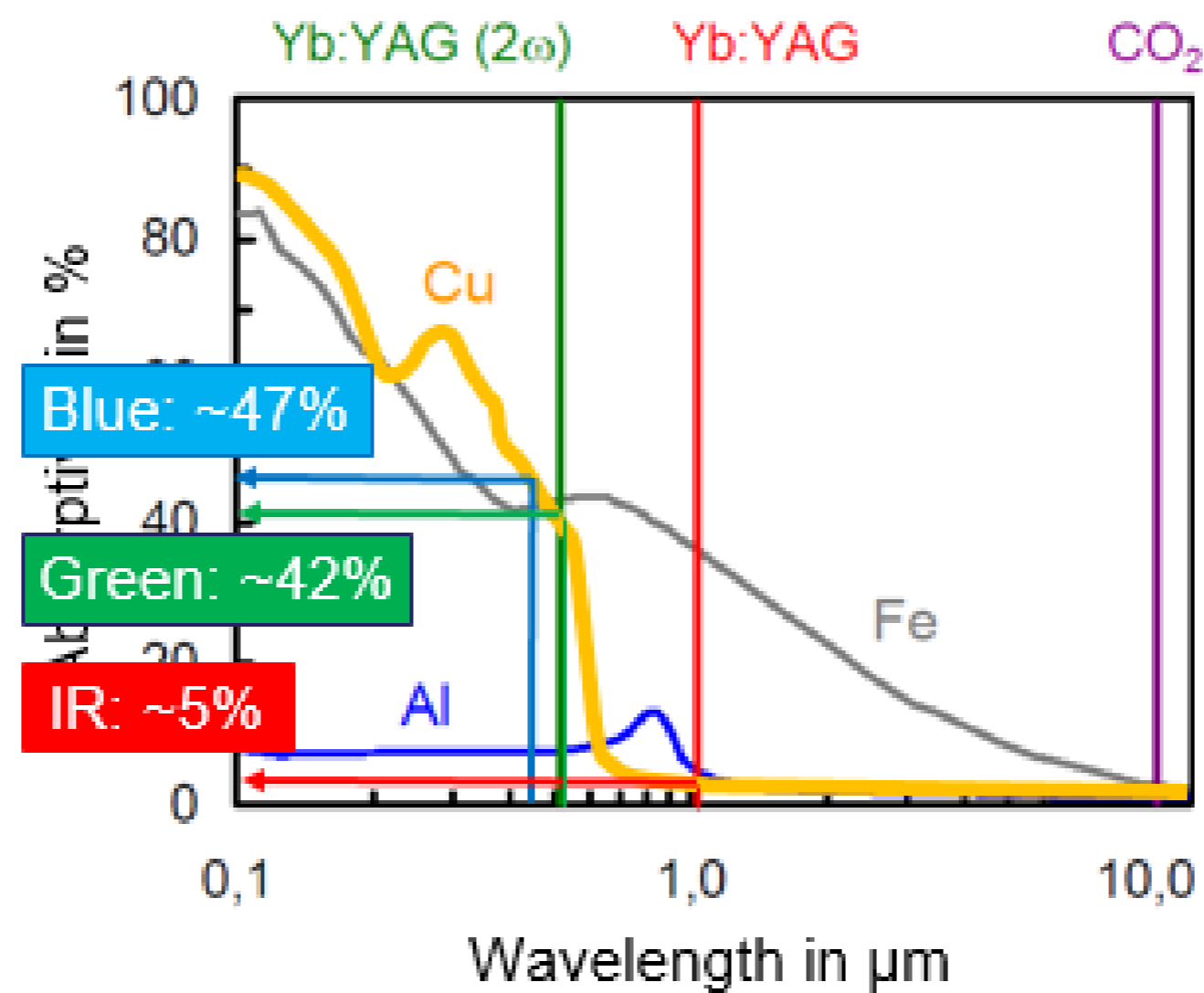
COPPER vs LASER

Absorption and heat conductivity

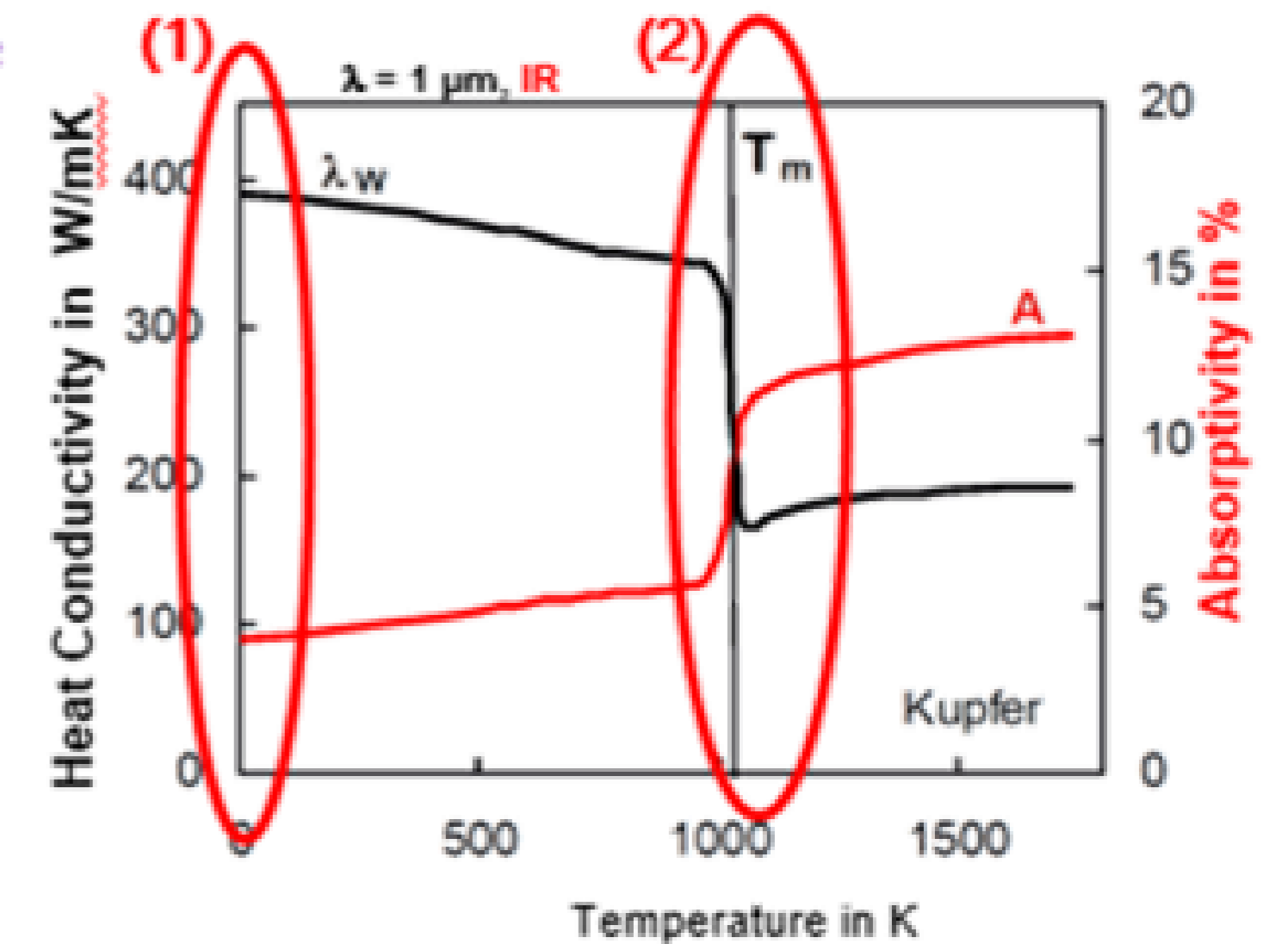
CRITICAL ISSUE ON COPPER

- Low absorption of infrared light (Yb:YAG) 5%
- Absorption increases after melting at IR
- Heat conductivity is higher at solid state

ABSORPTION OF COPPER



HEAT CONDUCTIVITY



01

Different wavelength might help increasing the absorption at material solid state

02

Blue diode maximize the absorption of copper in solid state condition

03

Blue laser could be used to easily bring the copper at melting point and later the IR could be used to penetrate more

Hybrid laser application

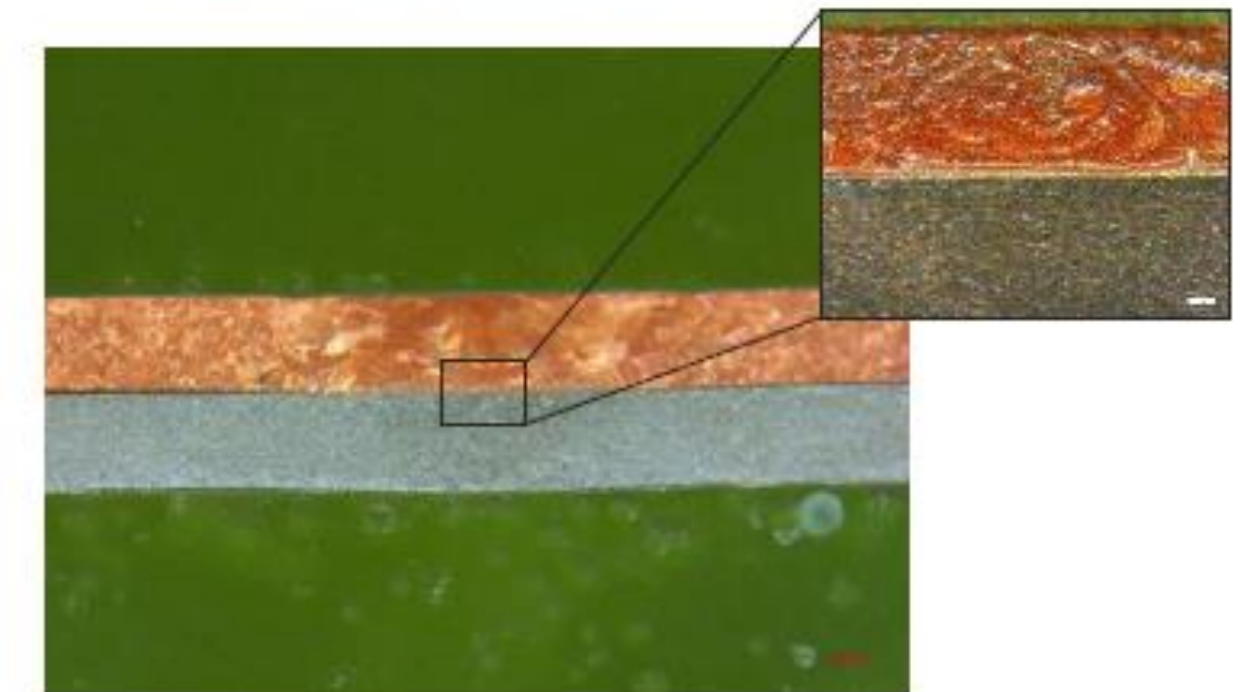
Absorption and heat conductivity

CRITICAL ISSUE ON COPPER

- Low absorption of infrared light (Yb:YAG) 5%
- Absorption increases after melting at IR
- Heat conductivity is higher at solid state



Cu 0.3 mm /
Steel 0.3 mm
P= 1200 W
v= 75 mm/s
d_{focus}= 1000 μm



01

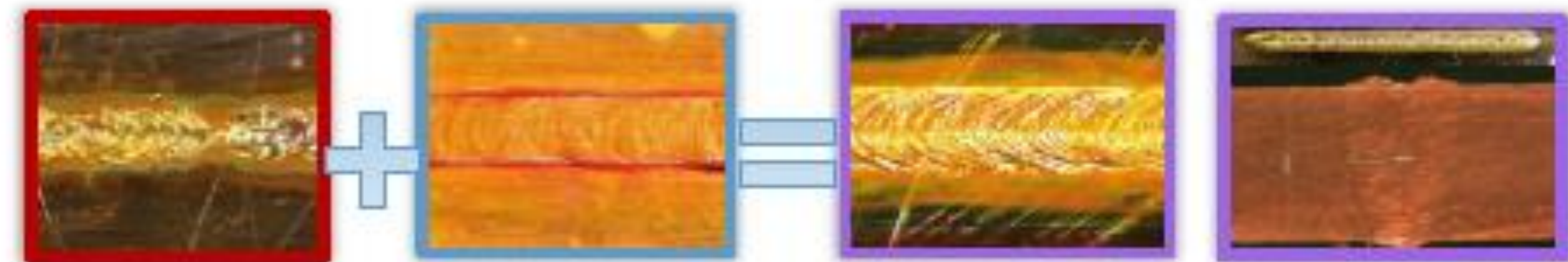
Different wavelength might help increasing the absorption at material solid state

02

Blue diode maximize the absorption of copper in solid state condition

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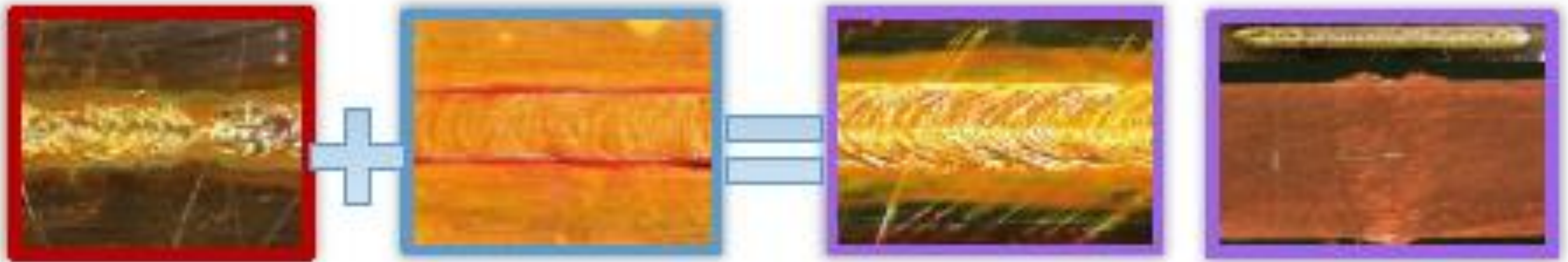
Blue laser could be used to easily bring the copper at melting point and later the IR could be used to penetrate more



**All the pictures are laserline propriety*

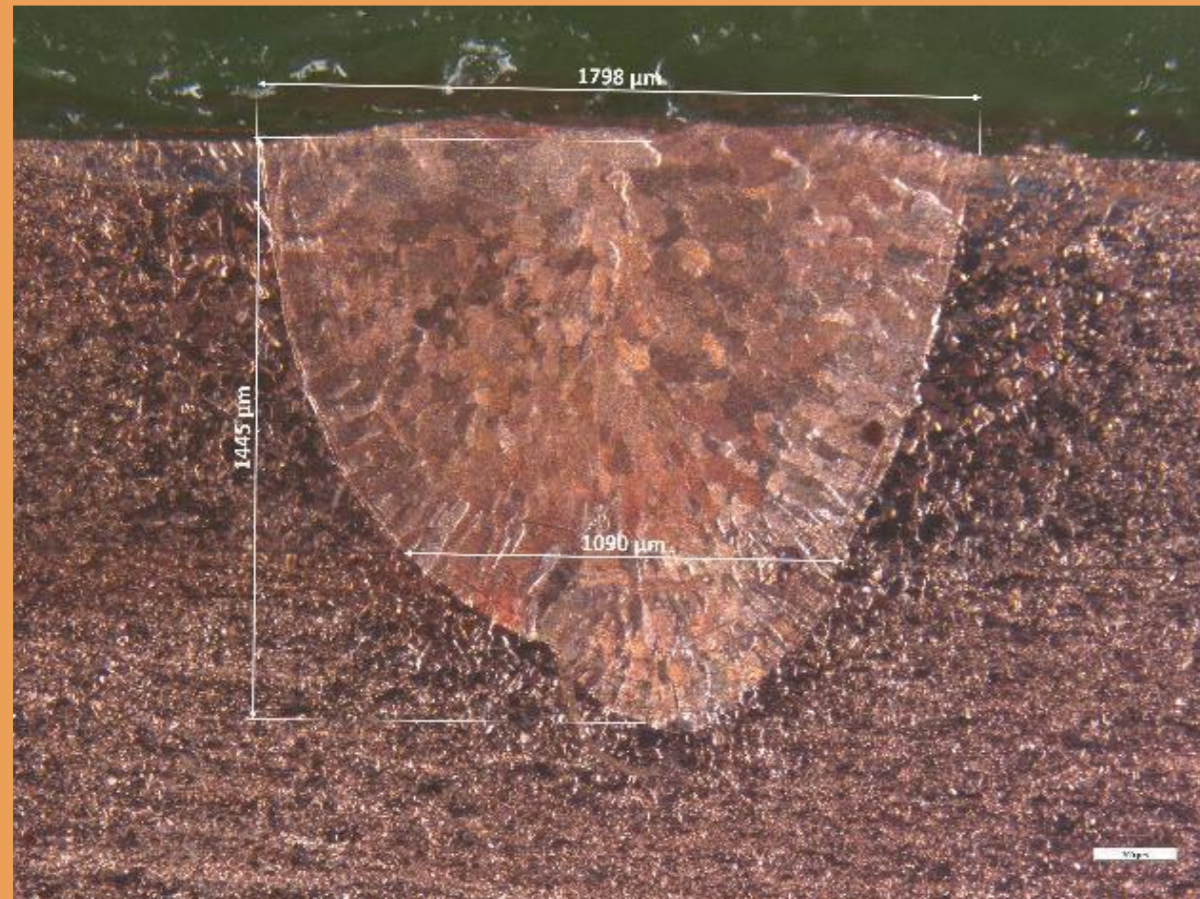
Hybrid laser application

Absorption and heat conductivity



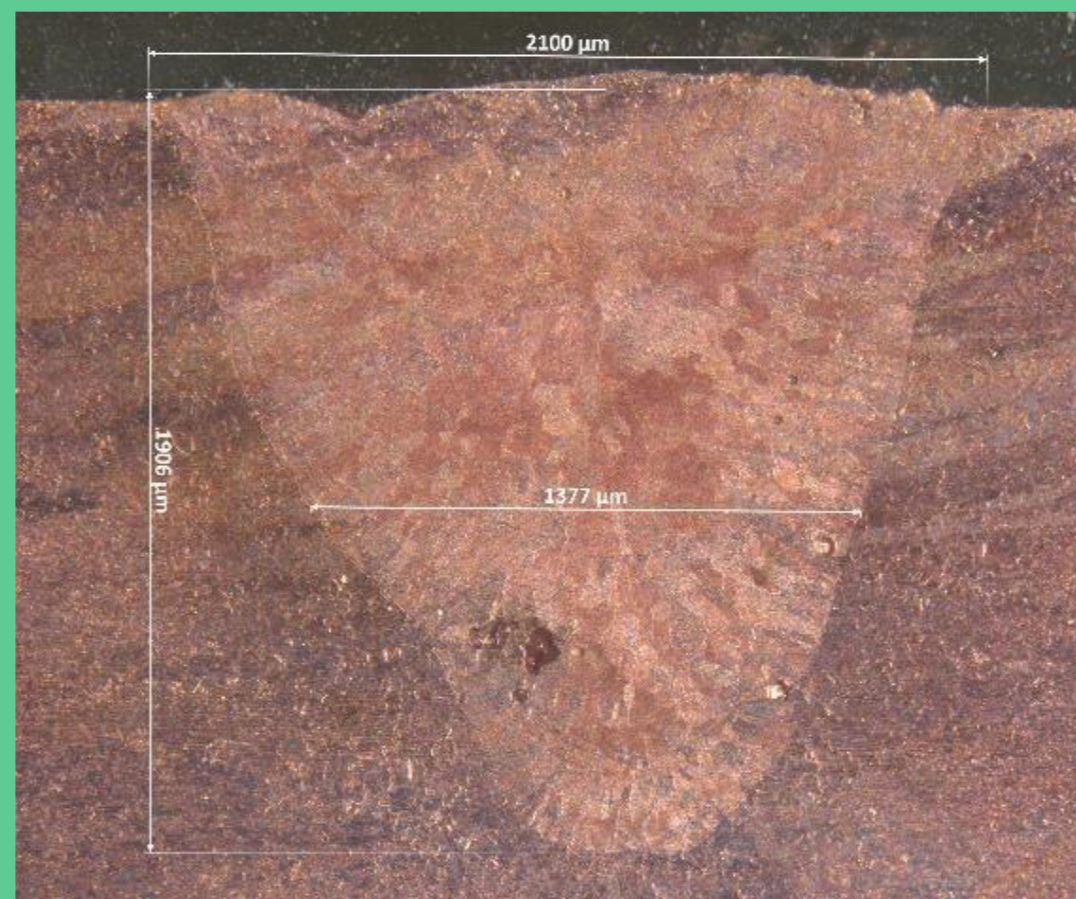
Hybrid laser application

Penetration capability



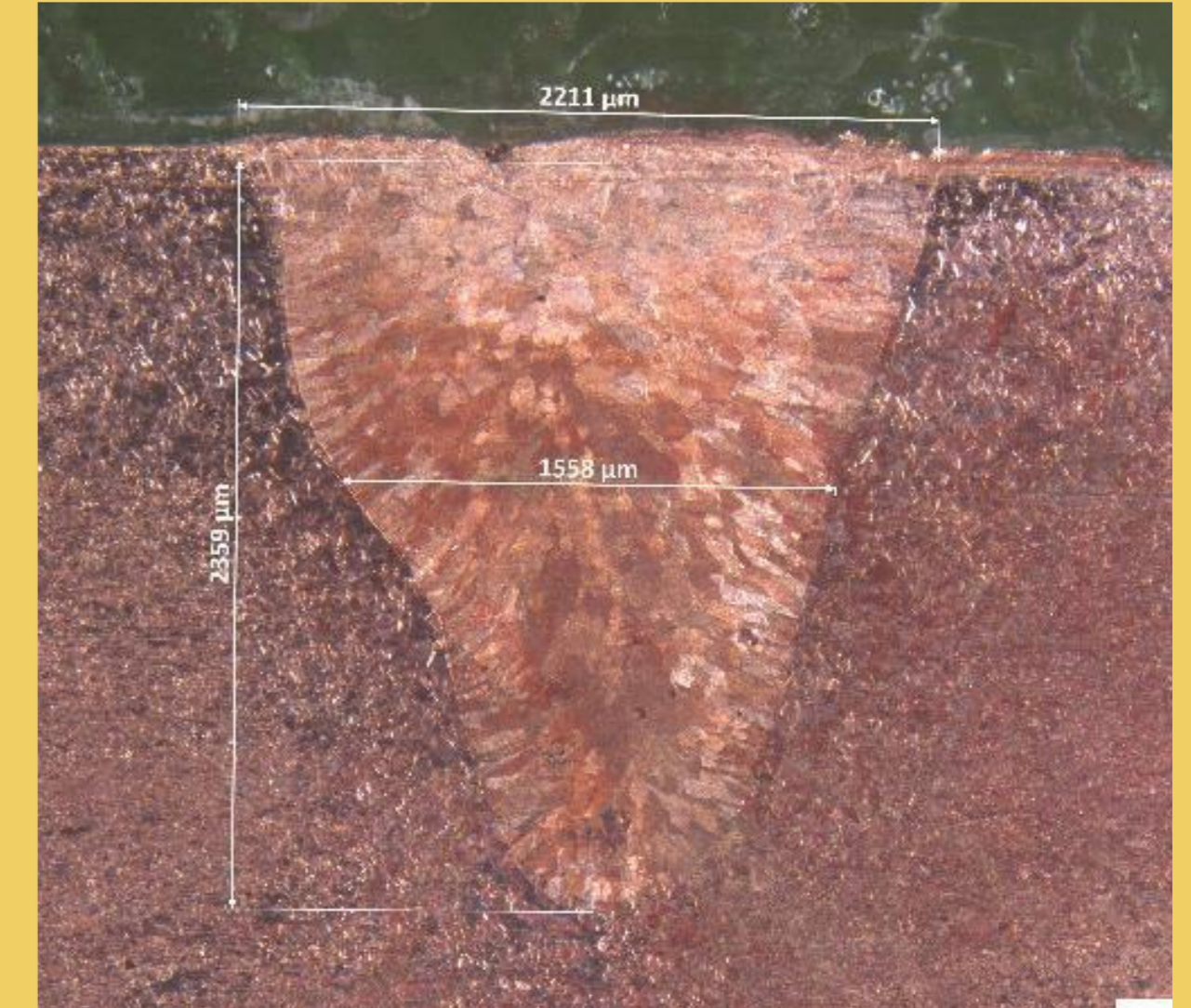
Description

1000 W Blue
3000 W IR
Penetration 1,45 mm



Description

1000 W Blue
3500 W IR
Penetration 1,91 mm



Description

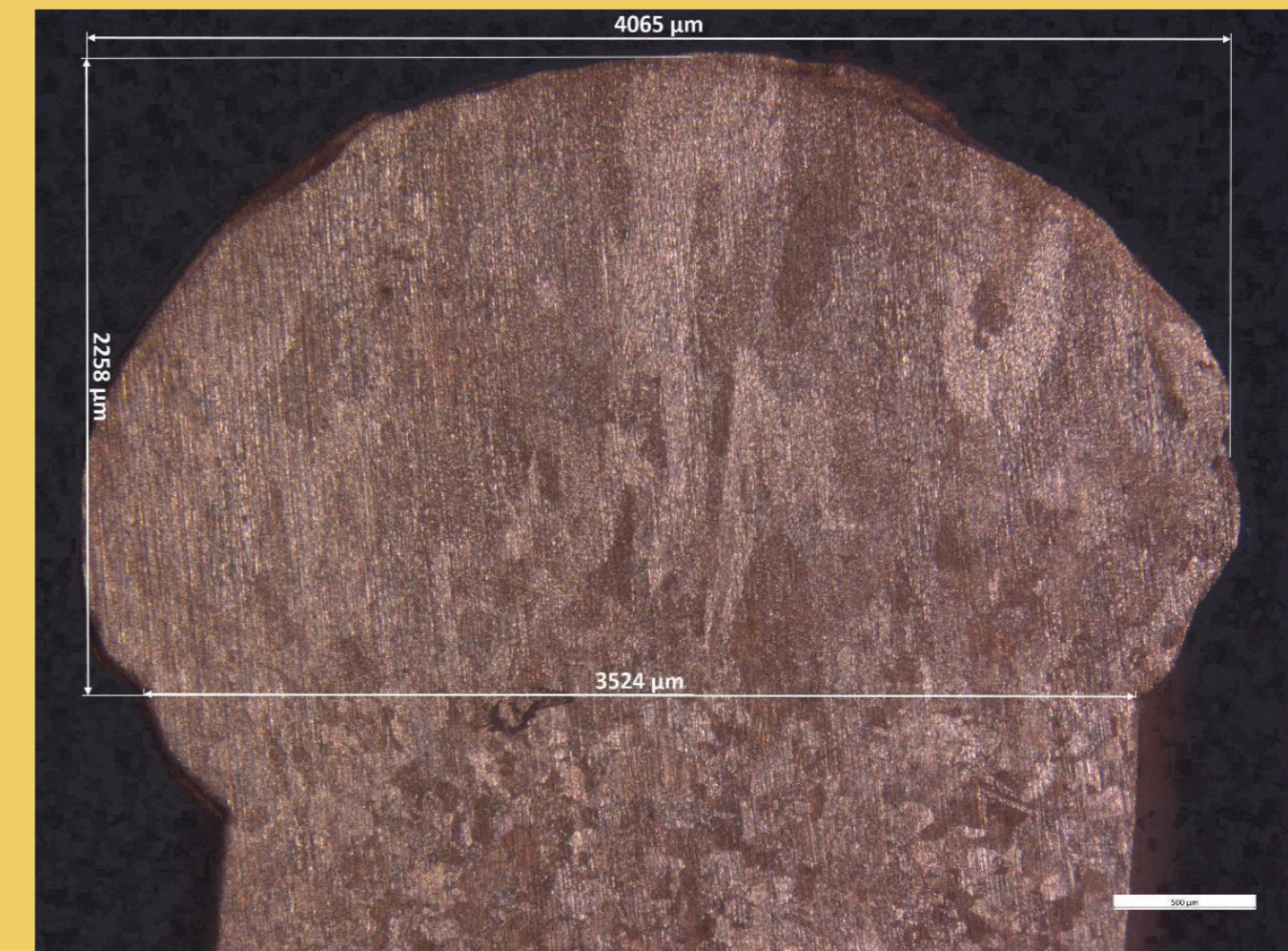
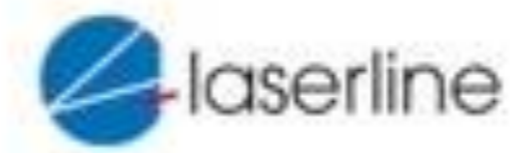
1000 W Blue
4000 W IR
Penetration 2,36 mm

Blue laser application

Hairpin

VIDEO

1 ms



INDEX

1

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01

There is no one beam shaping solution for every alloy and application, but commonly a higher intensity core plus a shoulder of power helps to widen the keyhole and improve stability

02

Outer ring could be used for enlarge the key-hole or pre-heat or post-heat the welding

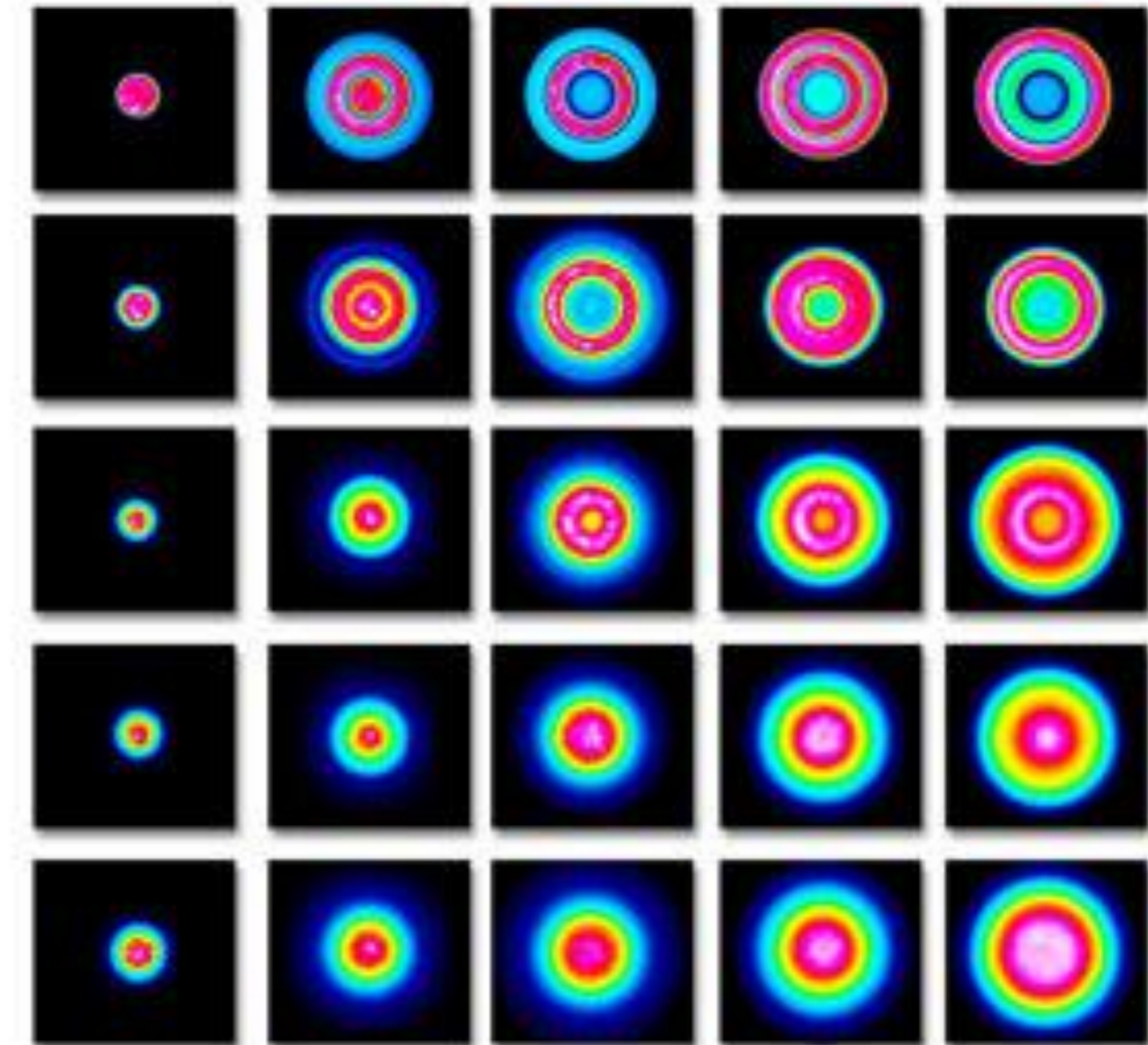
03

Fast process to limitate metallurgical mixture of incompatible materials



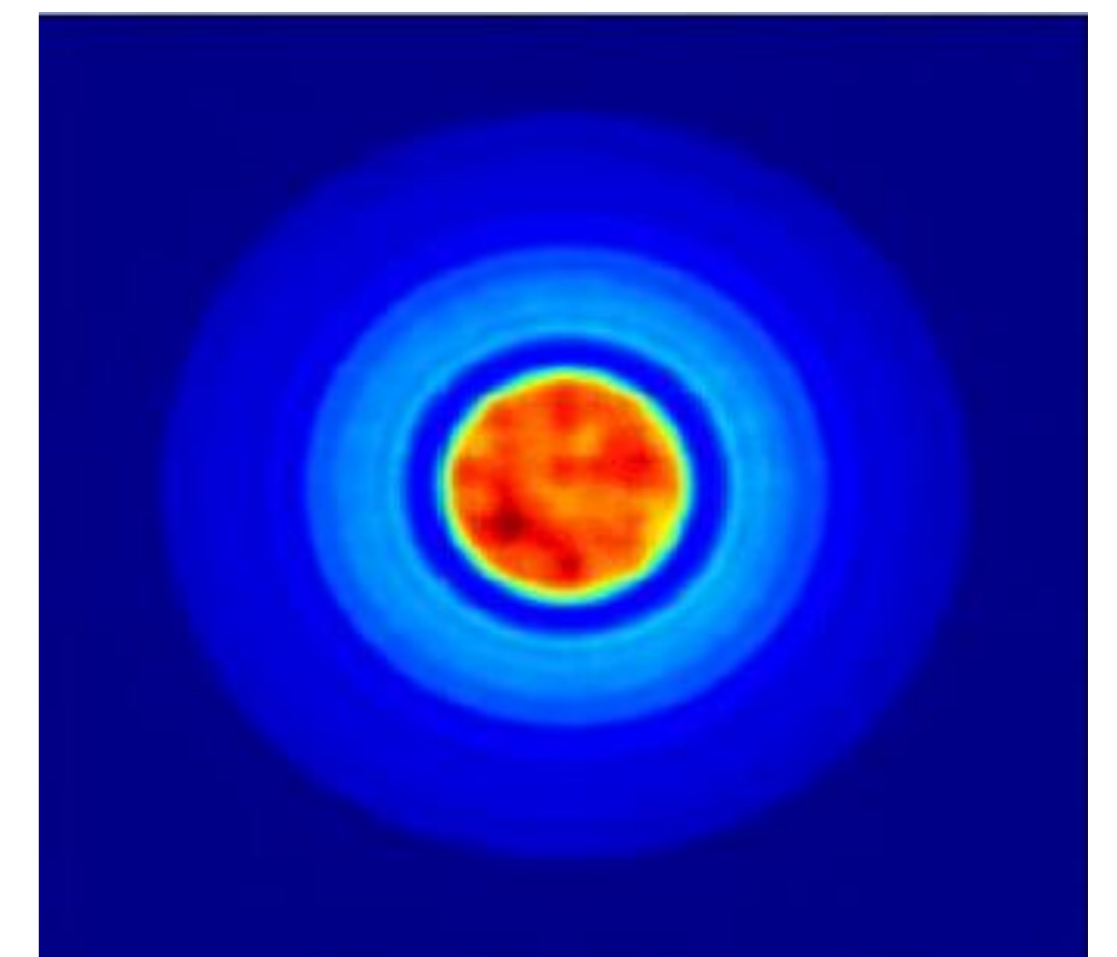
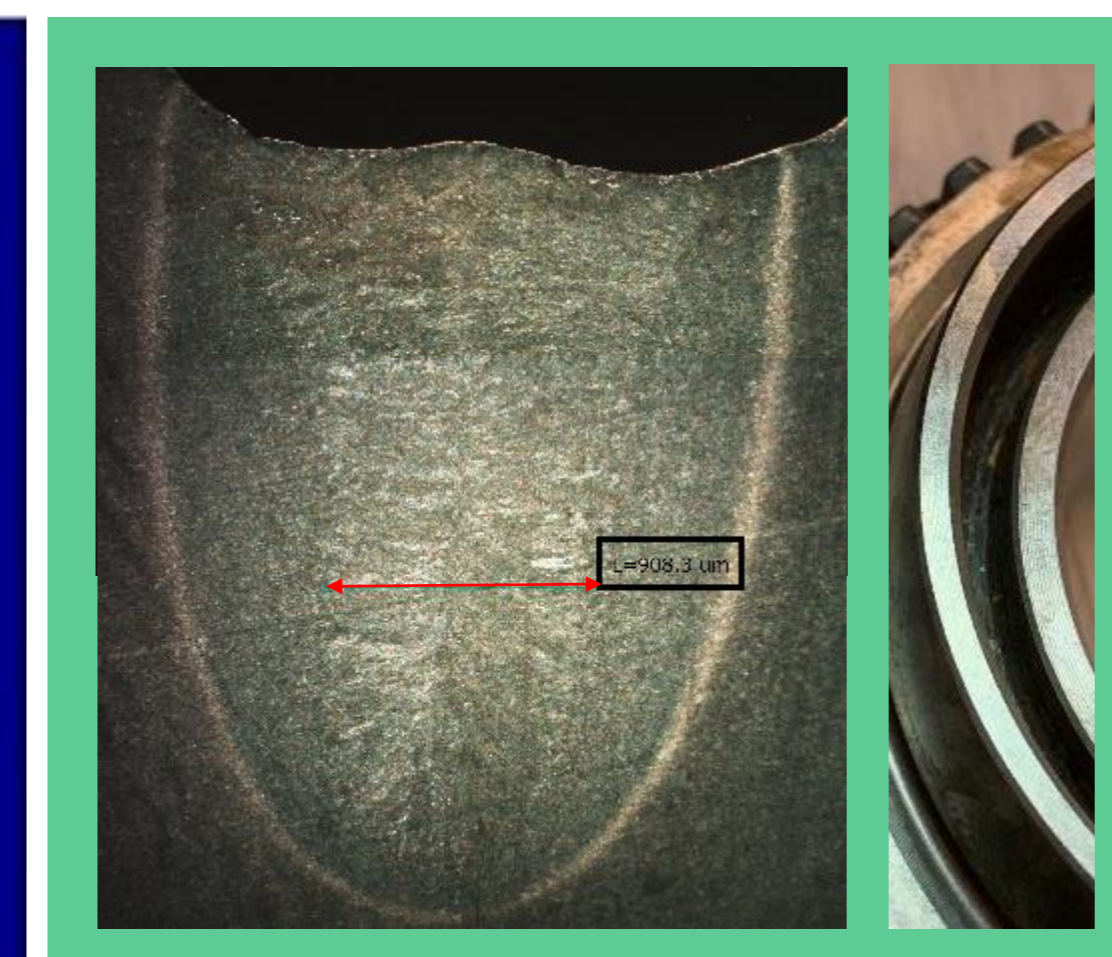
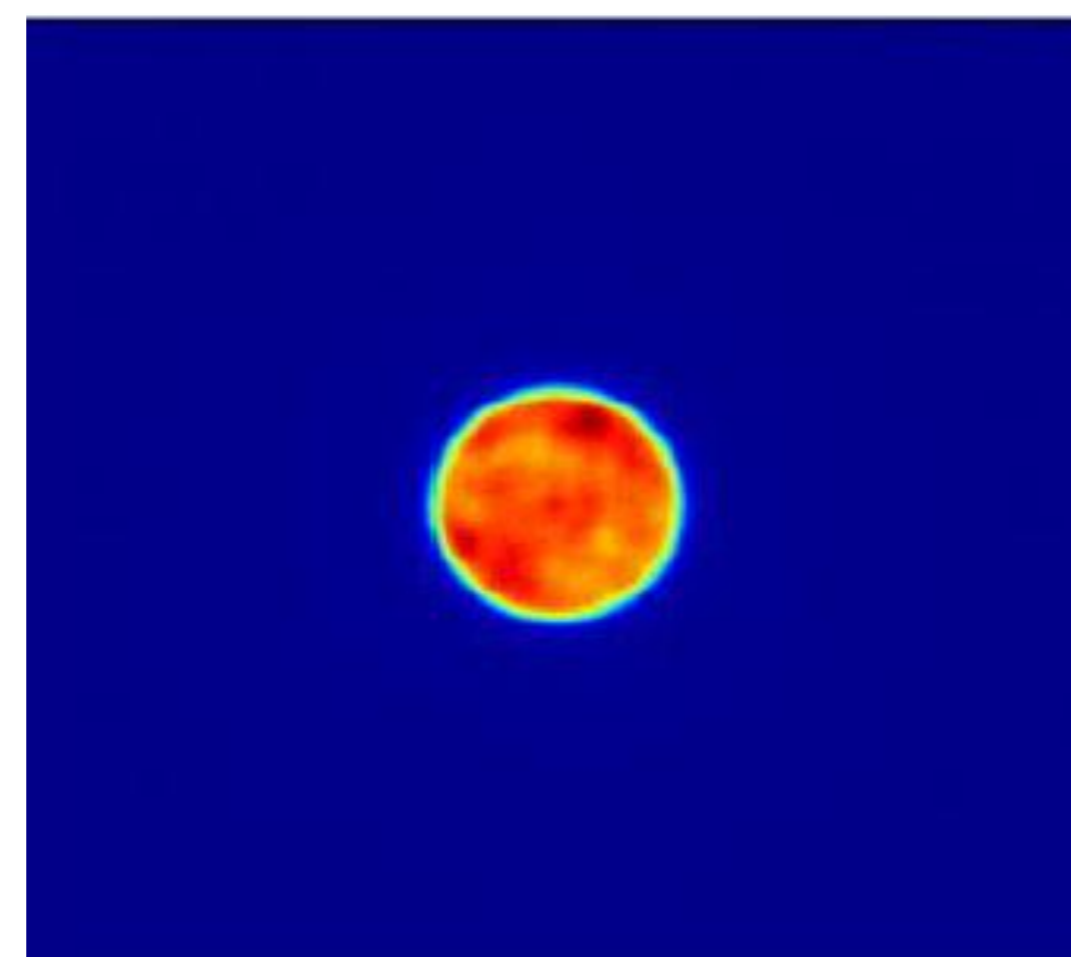
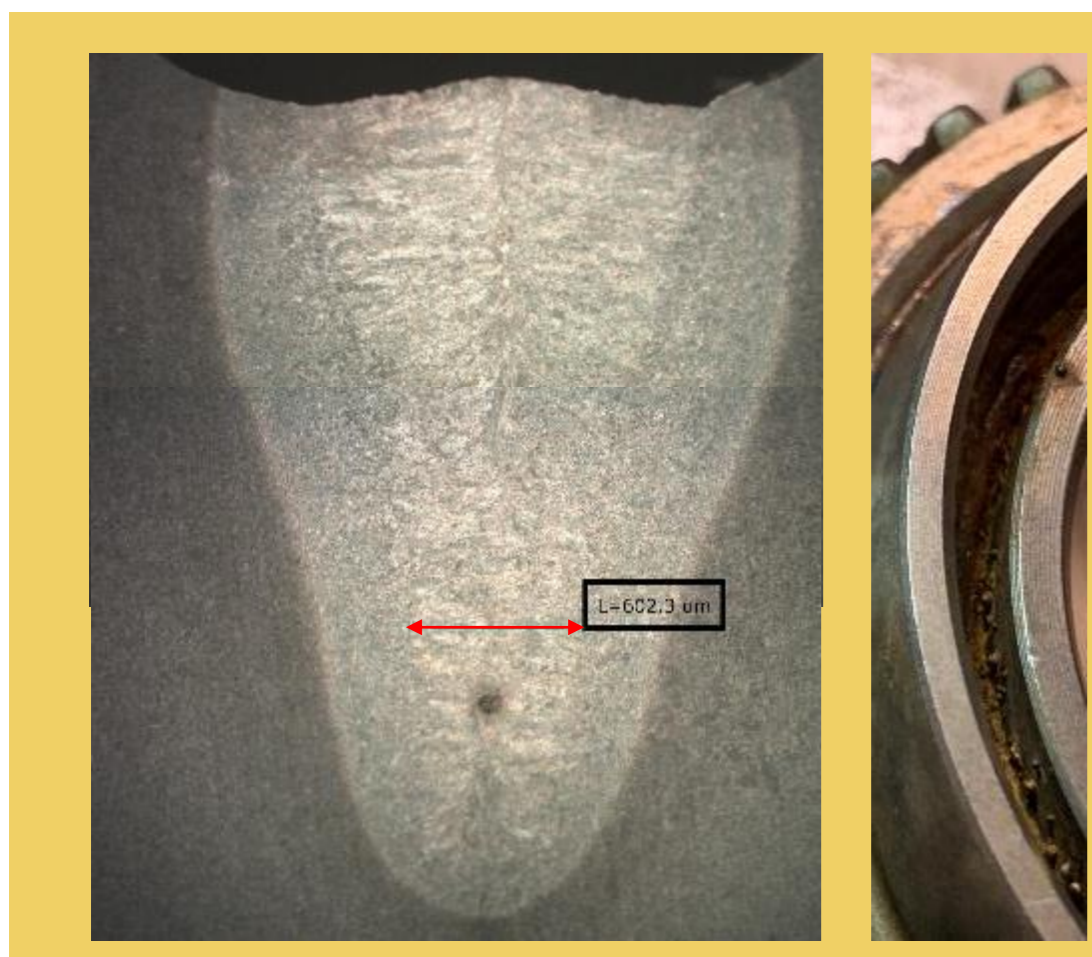
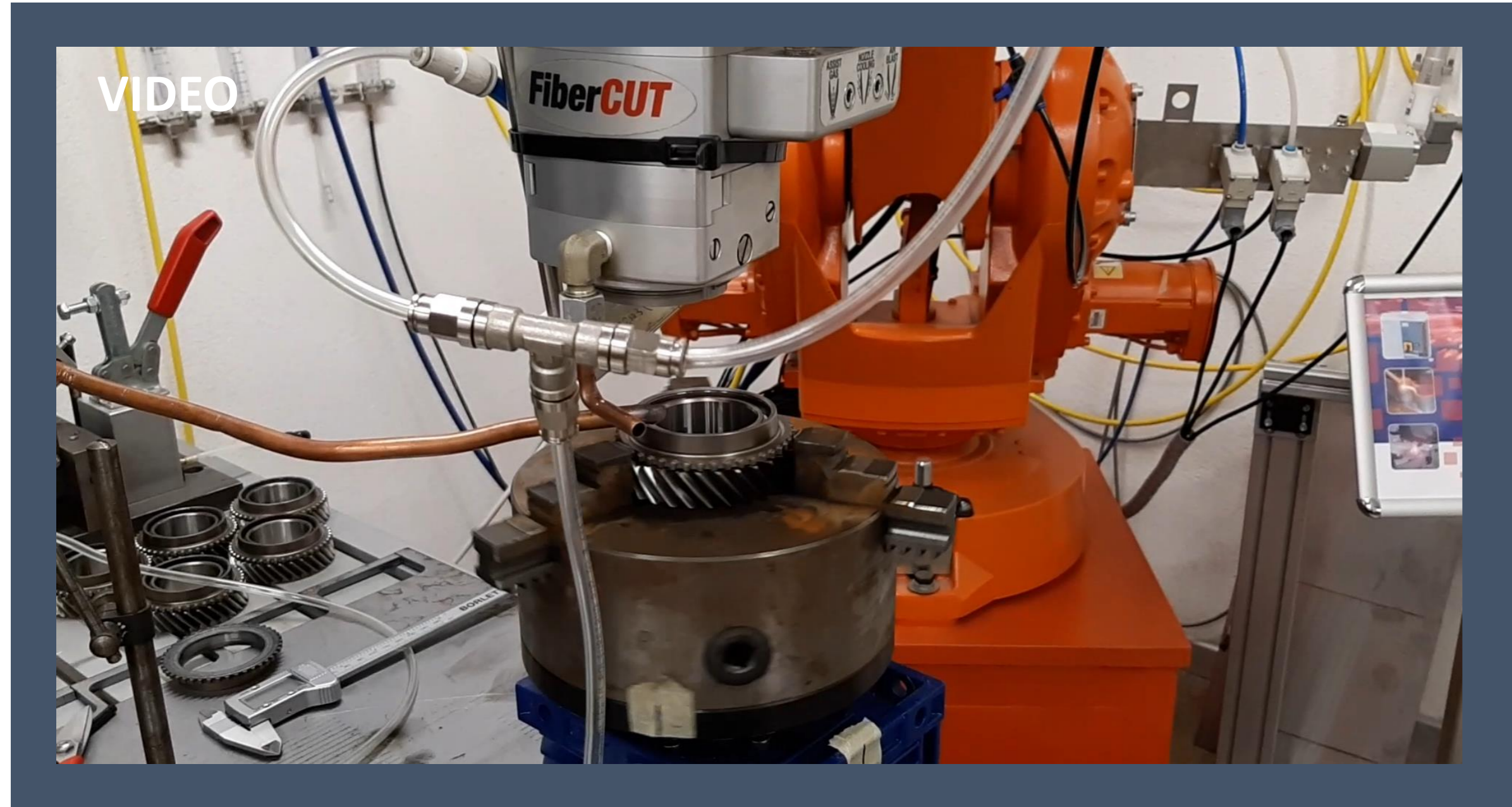
Fiber laser applications

Beam Shaping



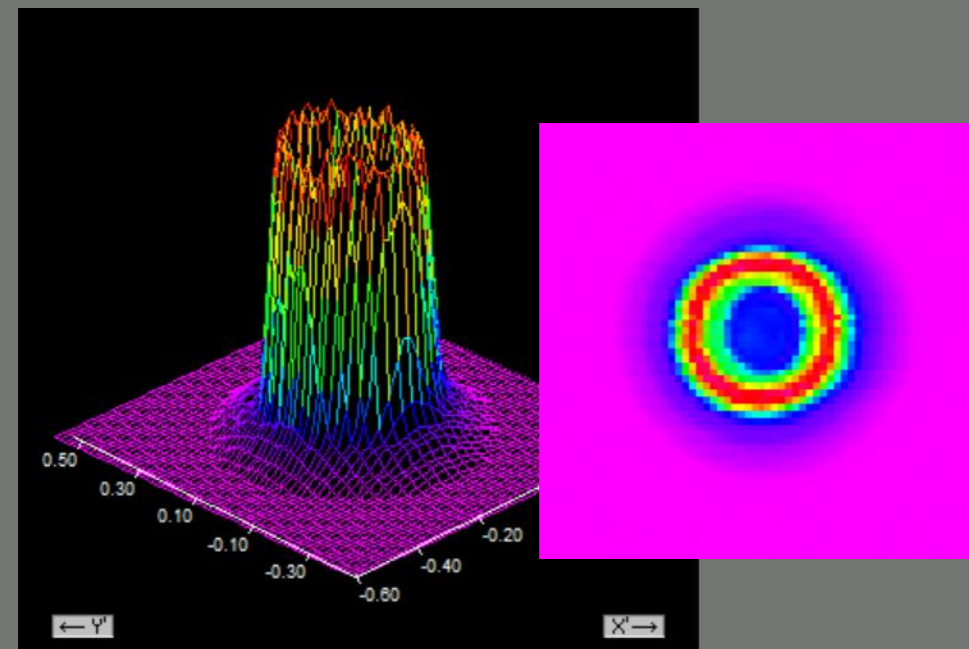
**All the videos are nLight propriety*

Summary

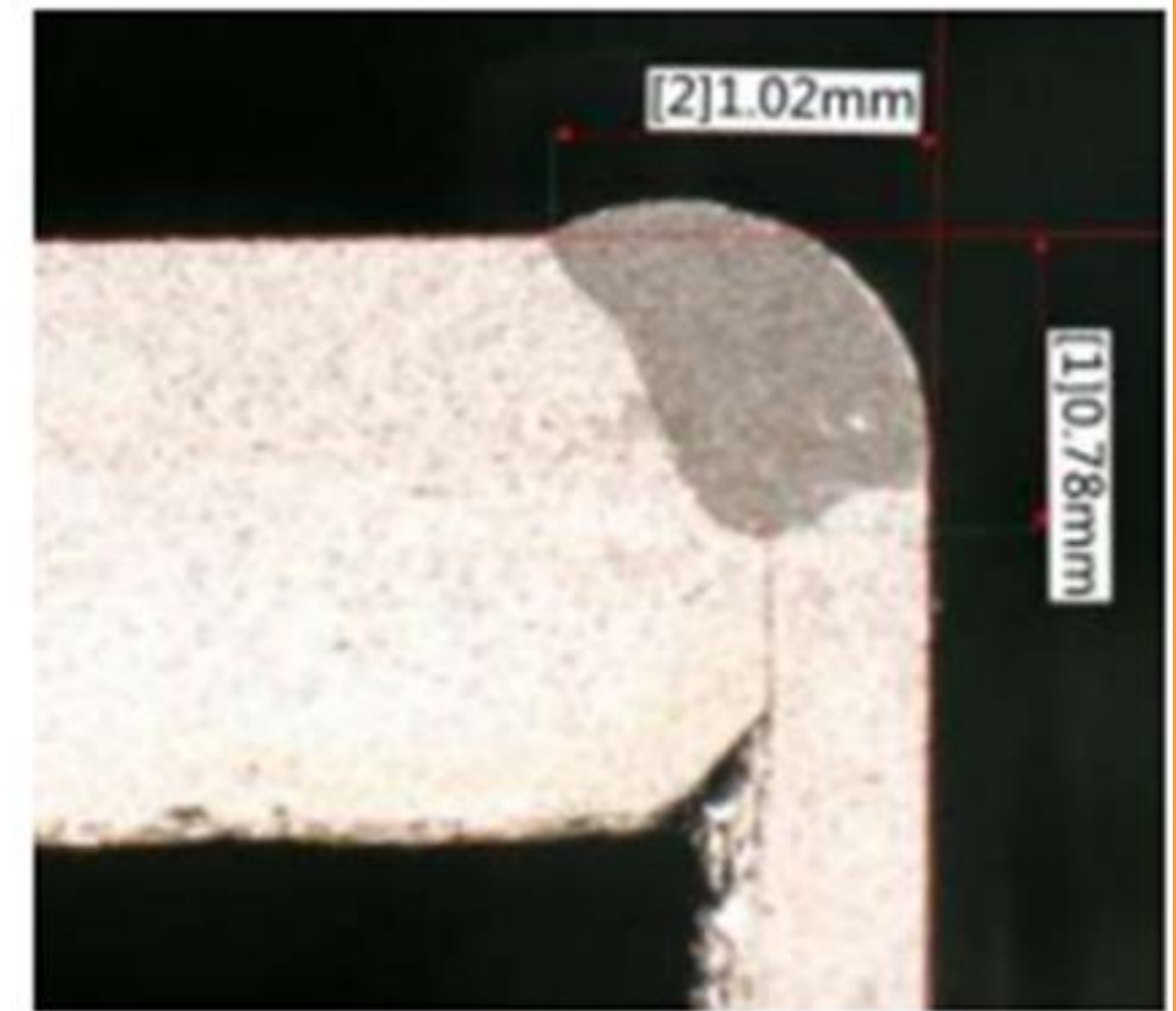
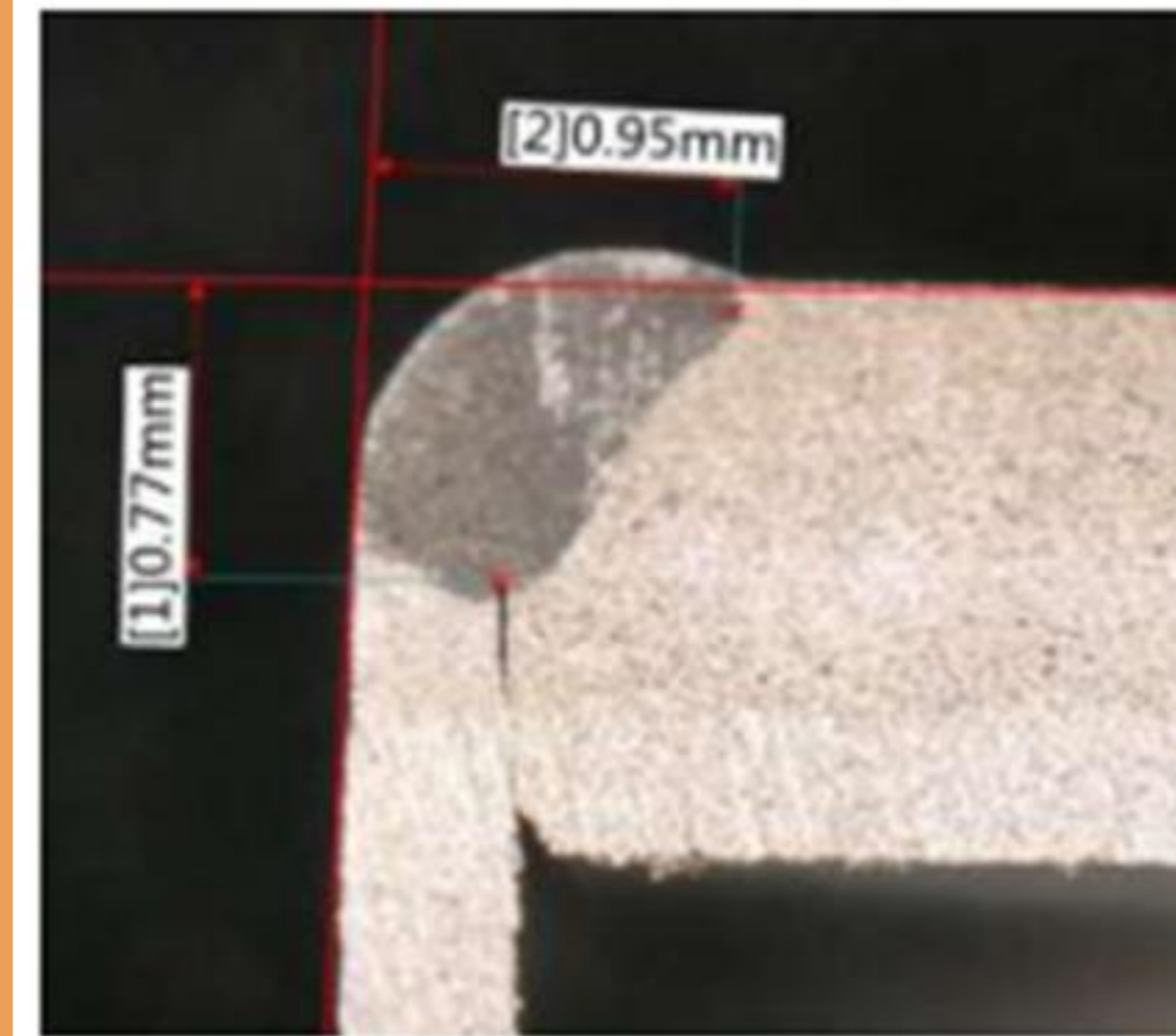


Application cases

Aesthetics examples



CFX-4000 @2.6 kW
Up to ~ 4kW
2.6 kW 200 mm/s
3.8 kW 300 mm/s
Met speed and quality specs



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3

4

5

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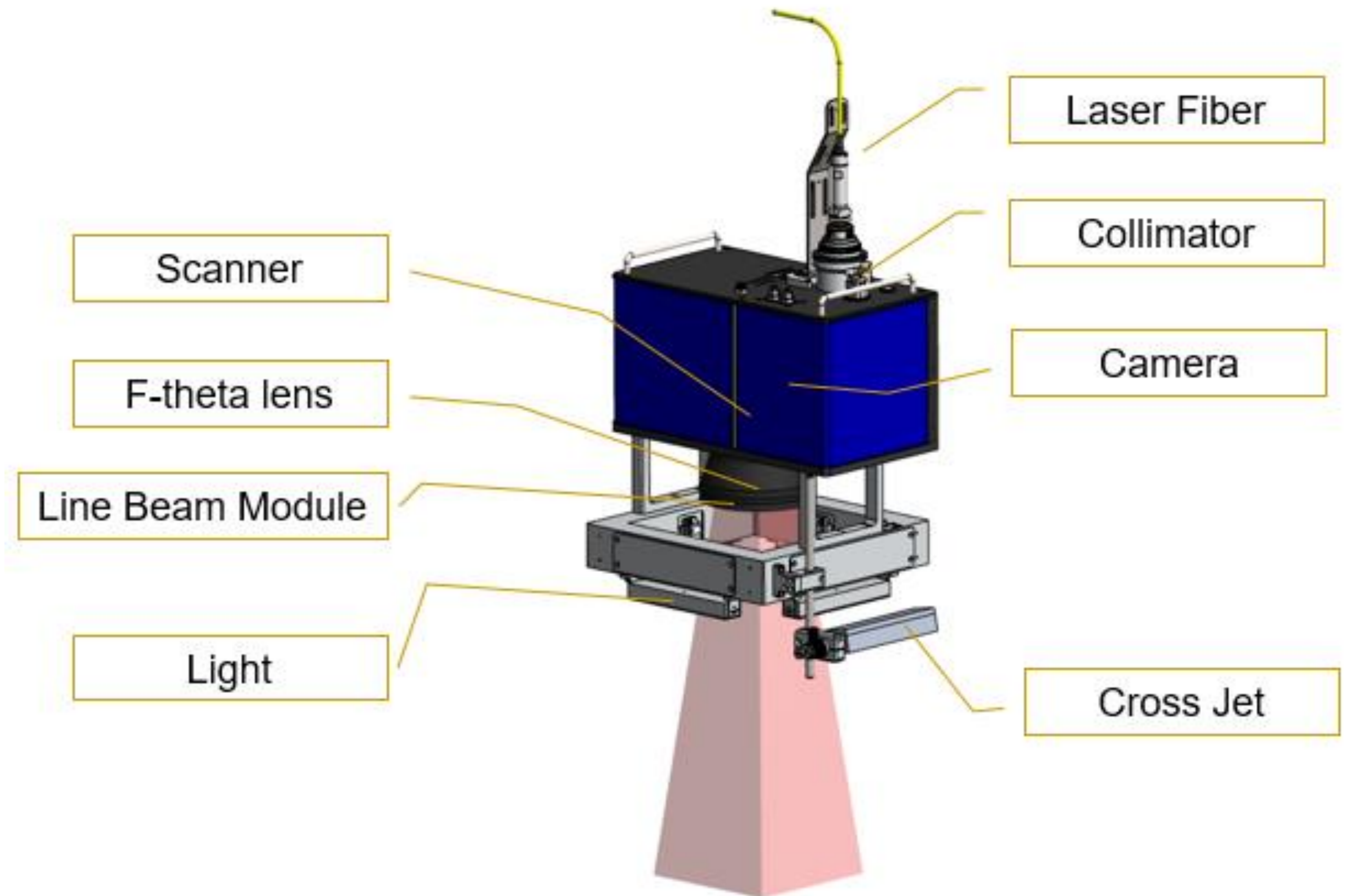
Absorption and heat conductivity

CRITICAL ISSUE IN POSITIONING

- Laser spot dimensions: order of 200 μm
- Large working area scanner
- Uncertainty in positioning the part in the same point

01 Pattern repositioning is needed

02 Simple scanning system to be integrated



**All the pictures are K-Lab propriety*

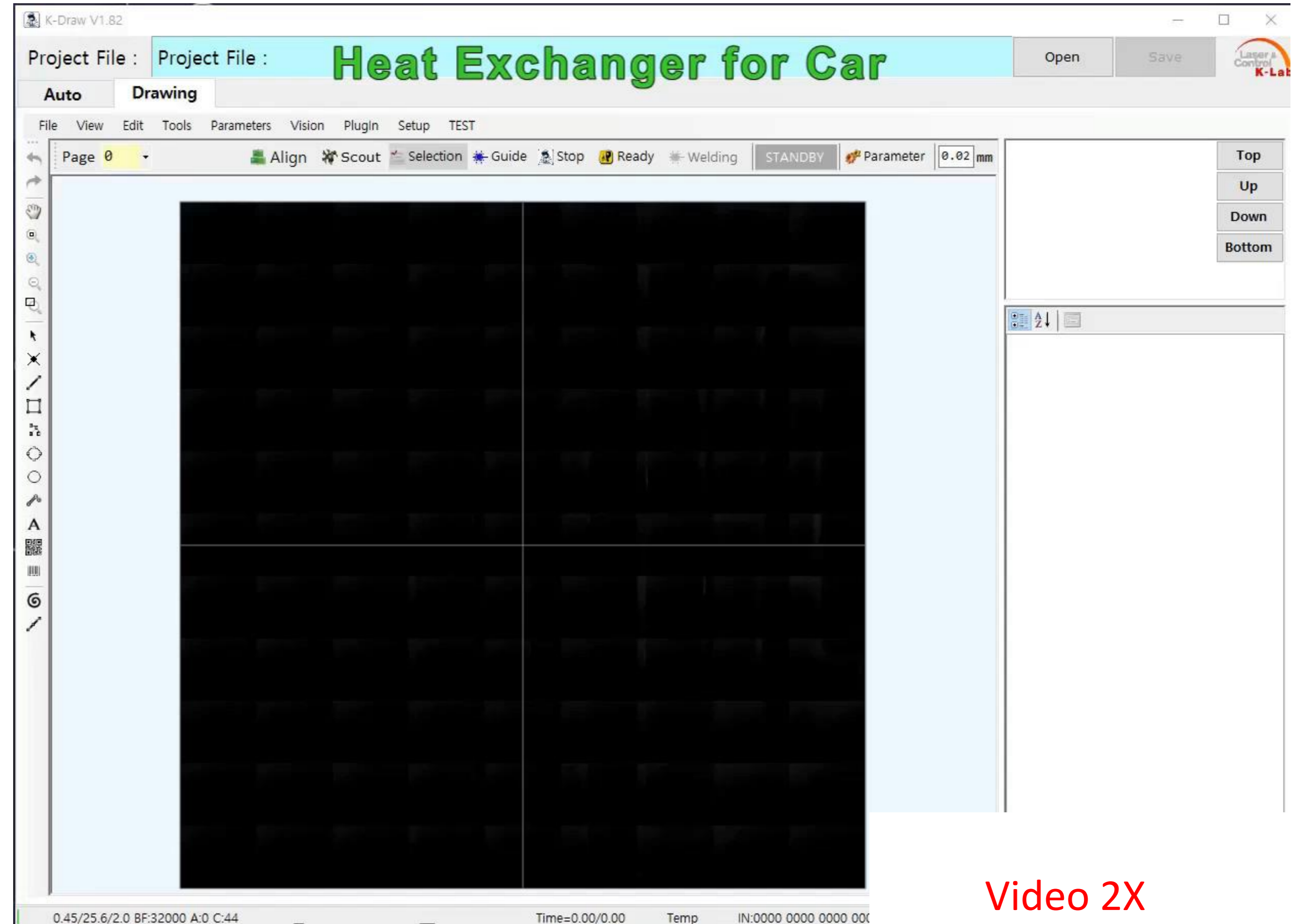
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01 Pattern repositioning is needed

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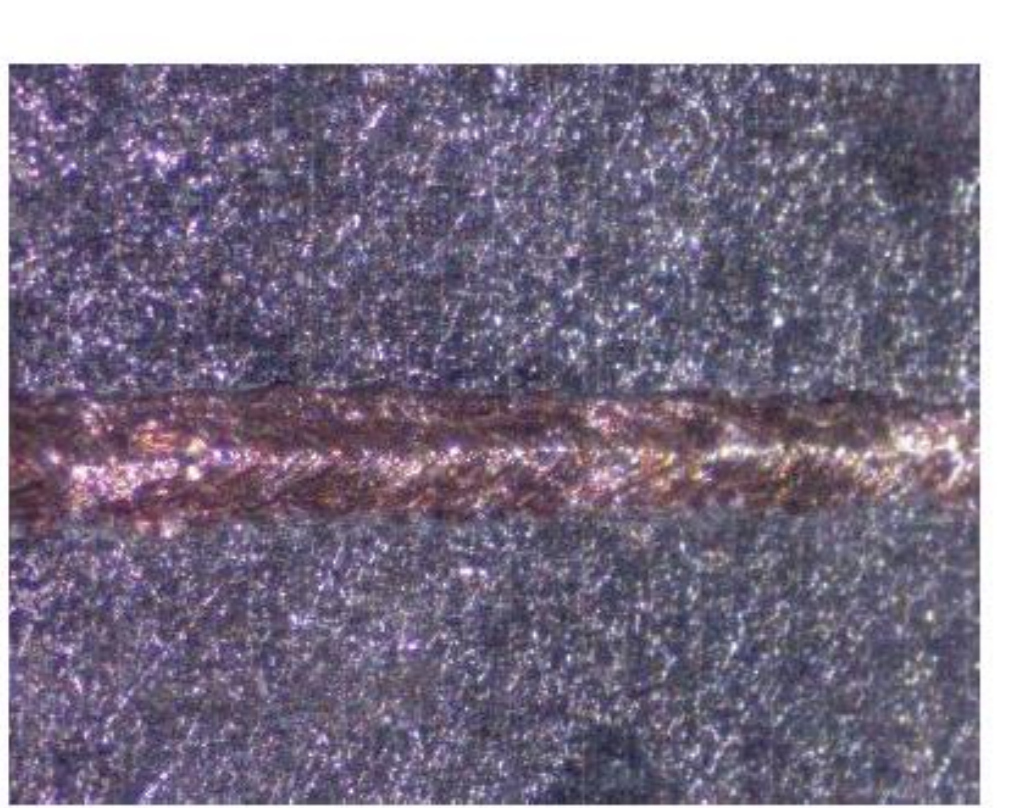
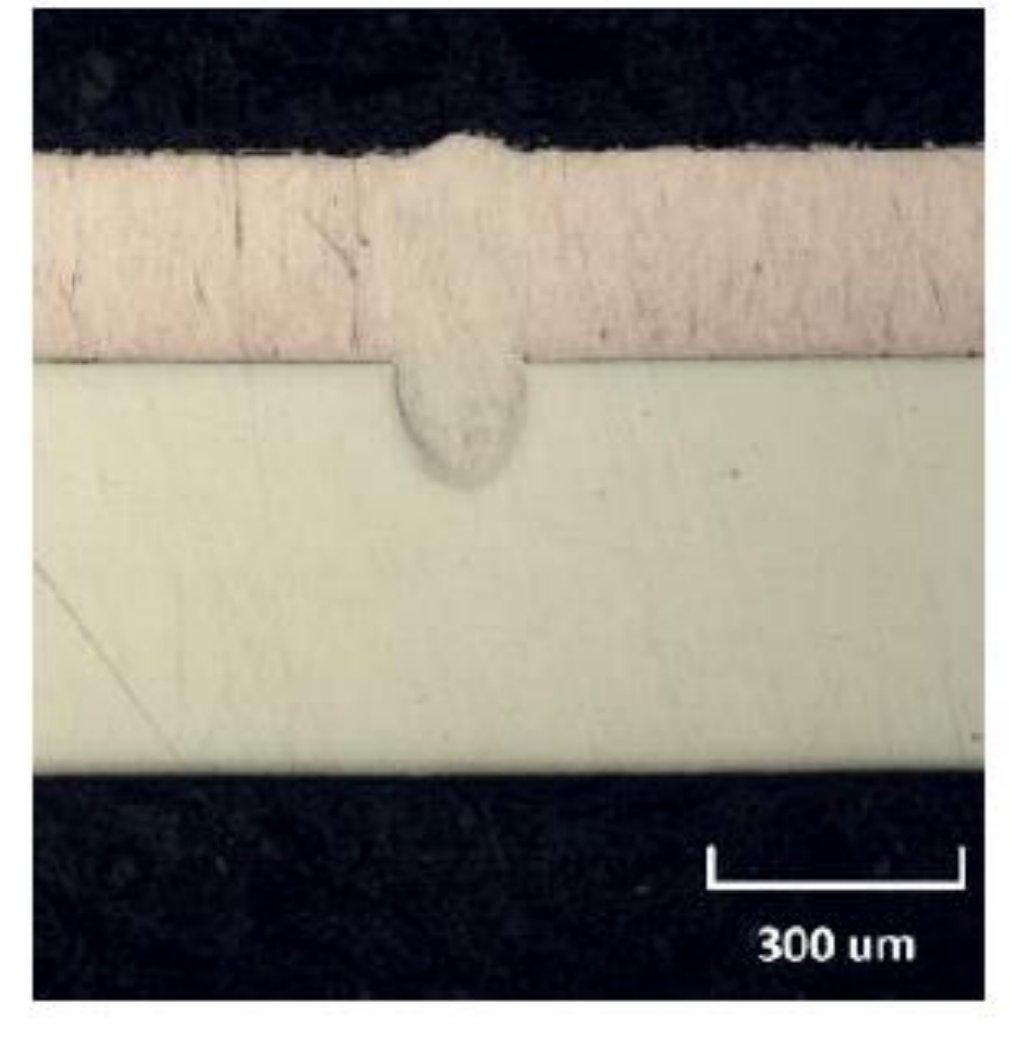


Video 2X

**All the videos are K-Lab propriety*

Application cases

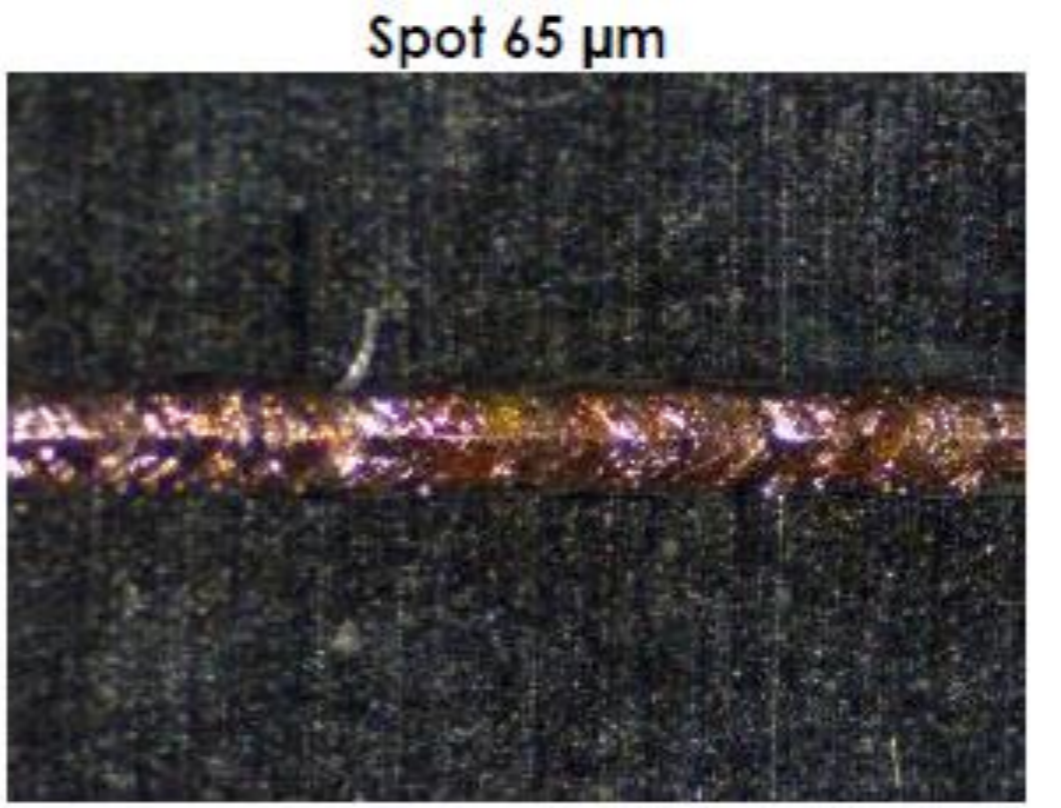
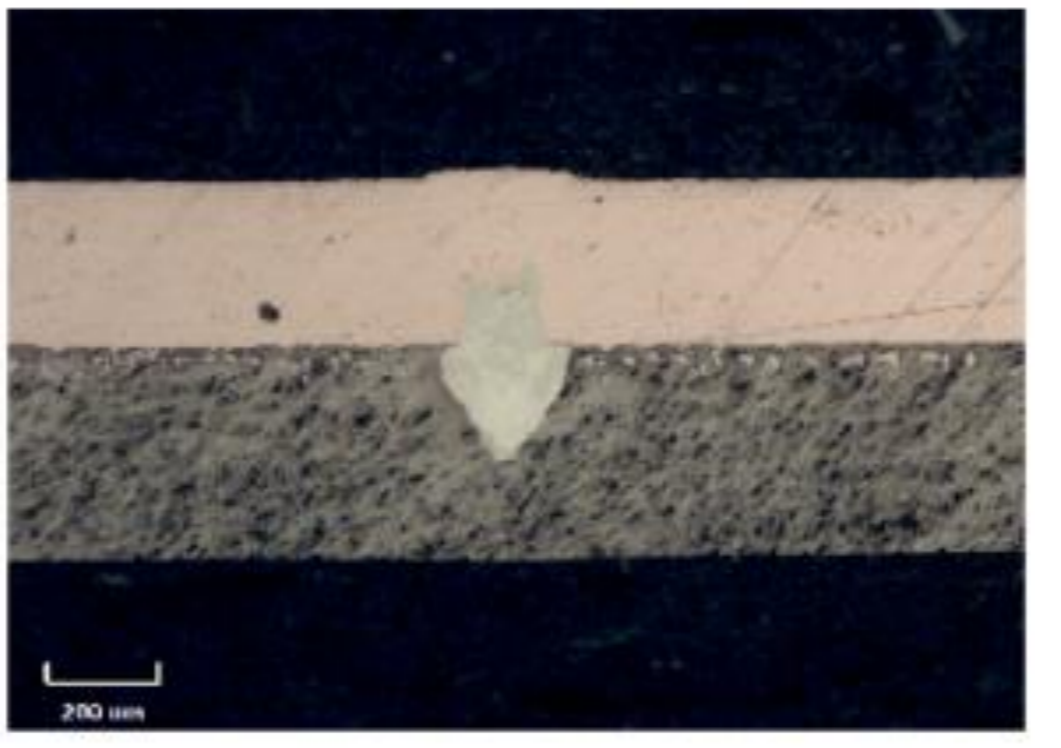
Fast process to mitigate metallurgical material mixture


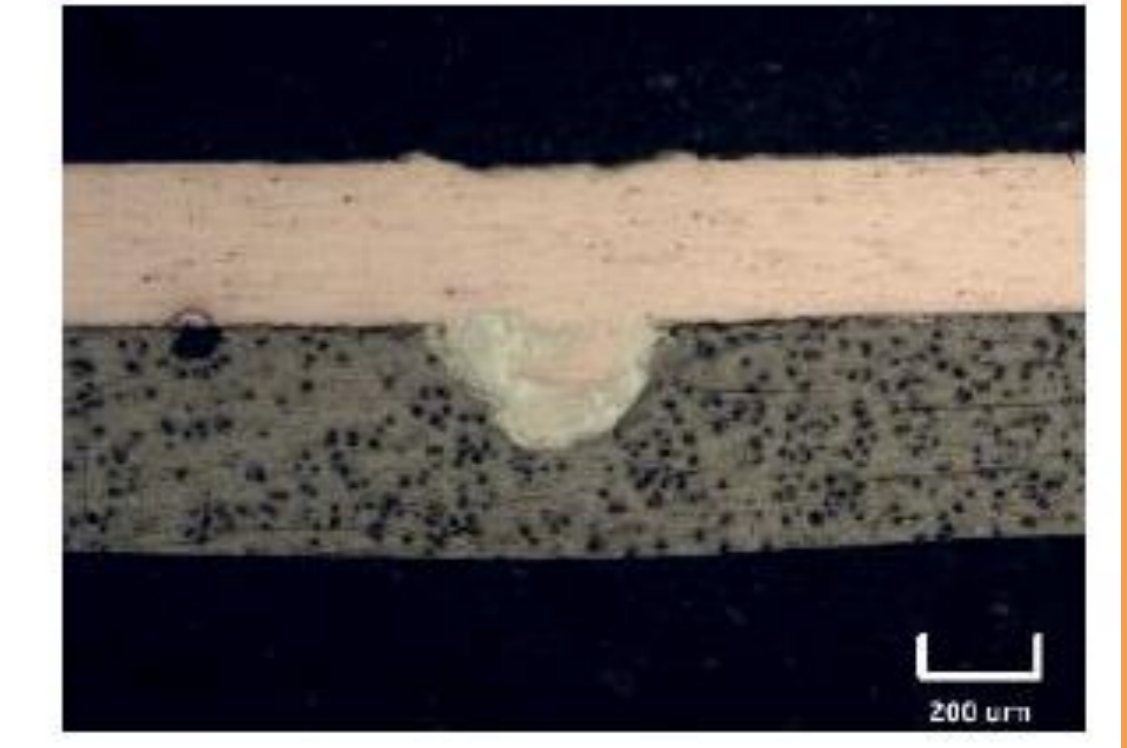
MATERIALS

Rame 0.2 mm
Acciaio 0.6 mm

Spot 65 µm

Spot 175 µm

MATERIALS

Rame 0.30 mm
Alluminio 0.45 mm

Saldatura Celle cilindriche

**All the pictures are uniBO propriety*



Application cases

Hairpin – Butteries



Tempo di saldatura = 0,25 [s]
Porosità < 1 %



Focali lunghe

**All the pictures are uniBO propriety*






MATERIALS

Al1050-Al1050

**All the pictures are uniBO propriety*






Welding speed

80 mm/s

Welding speed

60 mm/s

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INDEX



1

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- Applications solved

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- Keyhole requirements
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Remote welding

- Position uncertainty
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3

4

5

Conclusions

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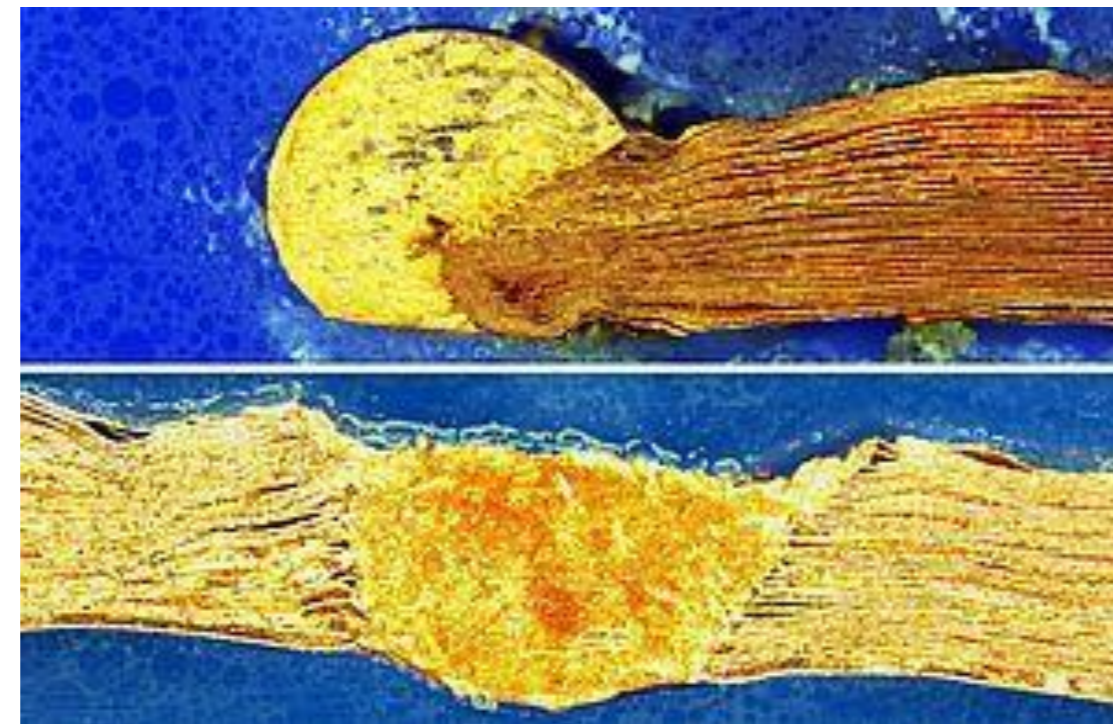
Conclusions

Application overview

APPLICATIONS

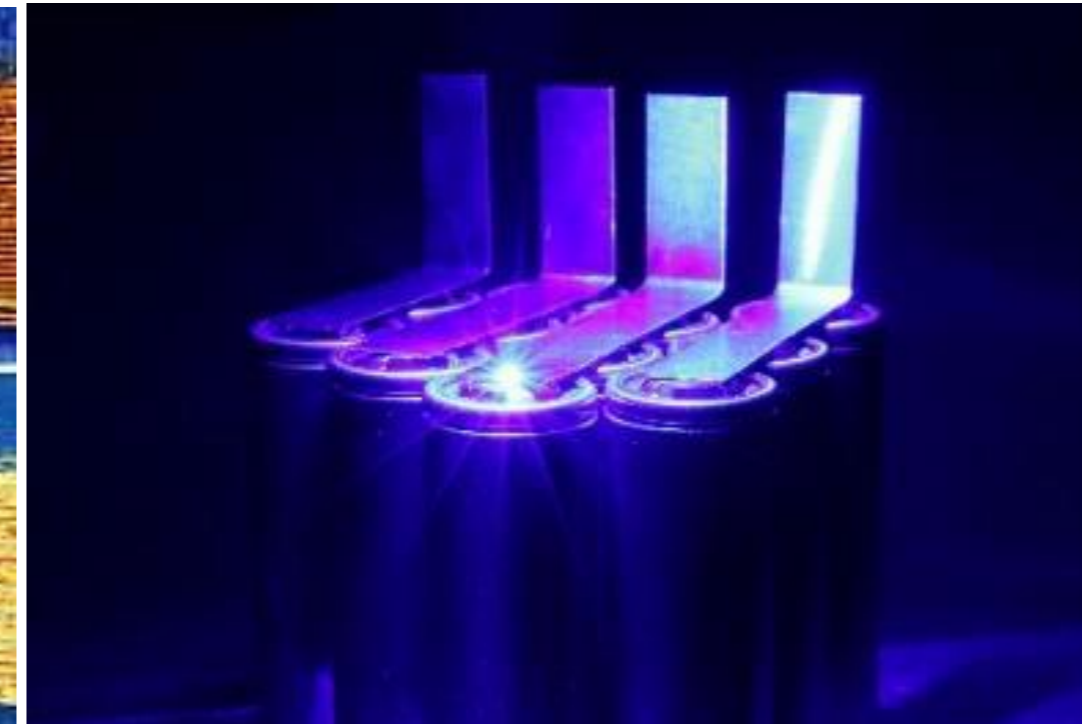
BLUE

Batteries cells, Thin hairpins, PCB
Copper foils



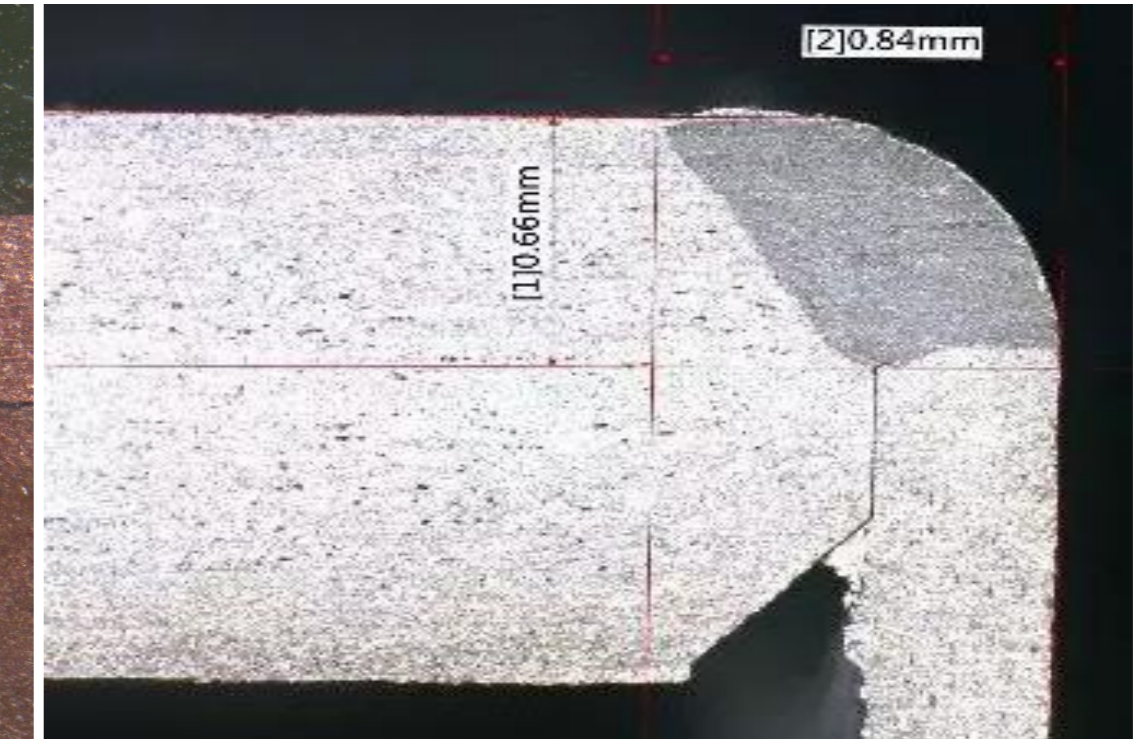
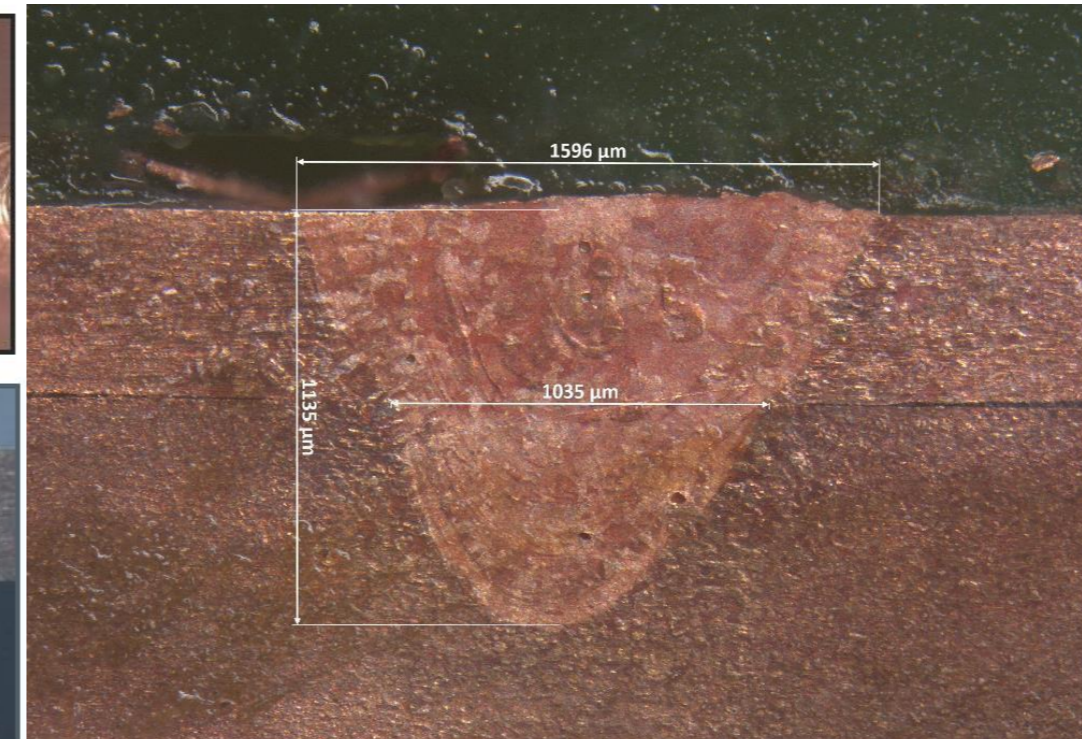
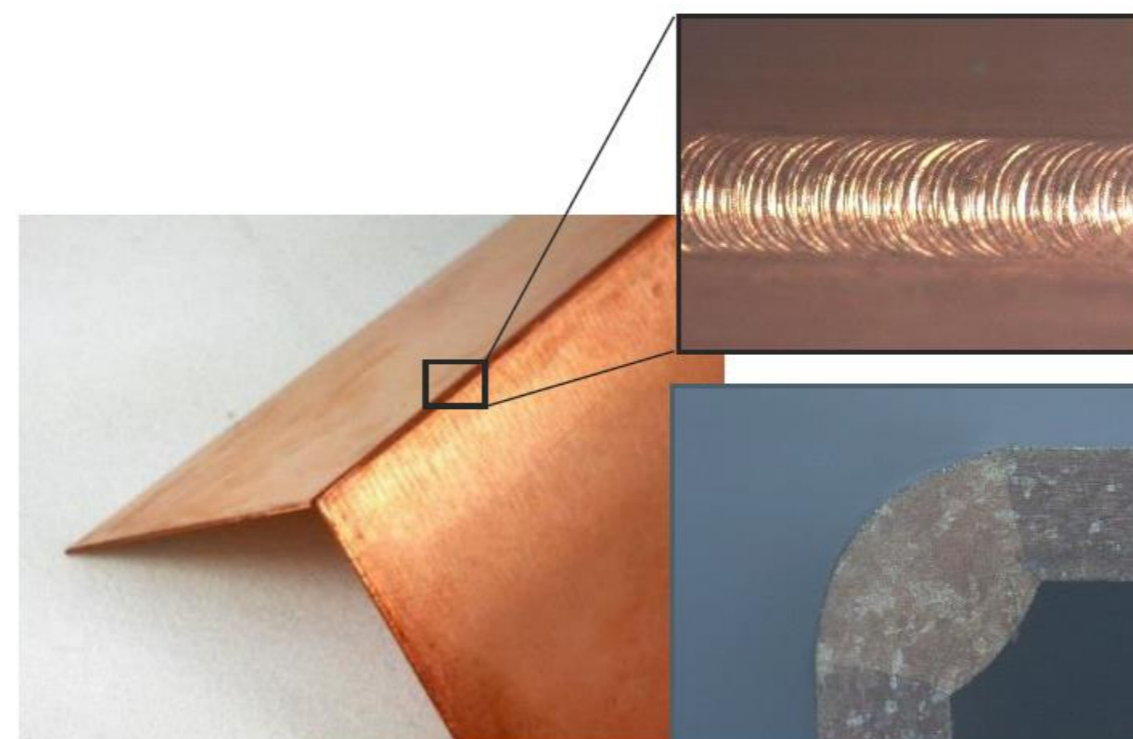
HYBRID

High power electronics
Thin and thick hairpins



IR

High power electronics
Thin & thick hairpins



Welding: set up options

Laser source



Fiber laser

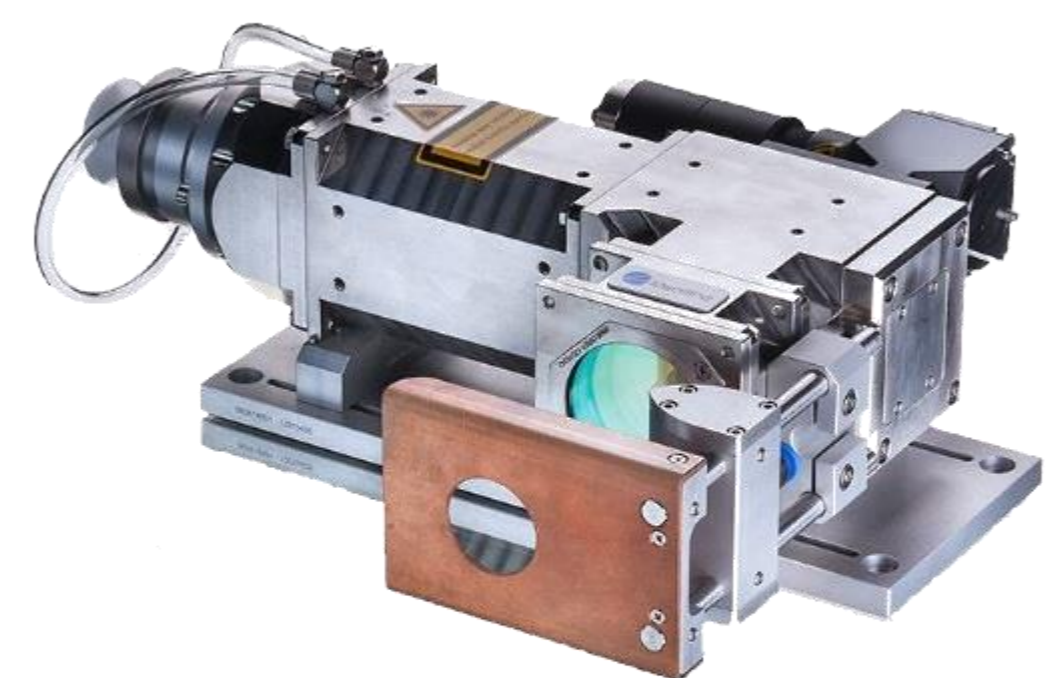


Blue/IR Diode Laser

Beam delivery

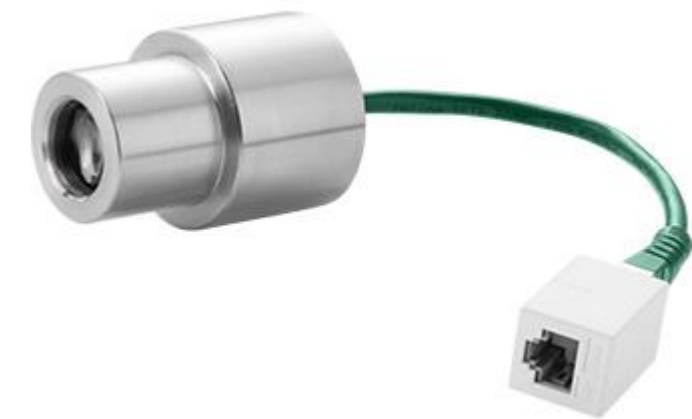


Remote welding



Proximity welding

Process monitoring



Weld watcher



Process observer

Contacts

Our locations

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Roma office

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