



EPIC – New Developments for Laser Welding

Examples of tailored solution in laser welding:

- Benefit of single mode lasers in aluminum remote welding

Agenda

A vertical image on the left side of the slide shows a robotic arm performing laser welding on a metal component. The scene is illuminated with blue and white light, highlighting the sparks and the precision of the process. Three colored circles (cyan, yellow, orange) are overlaid on the image, corresponding to the agenda items.

1

Company presentation

- Who we are
- What we can do for you
- What you can do for us

2

Examples of tailored solution in laser welding

- Benefit of single mode lasers in aluminum remote welding

3

Conclusions

Agenda



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Company presentation

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Who we are

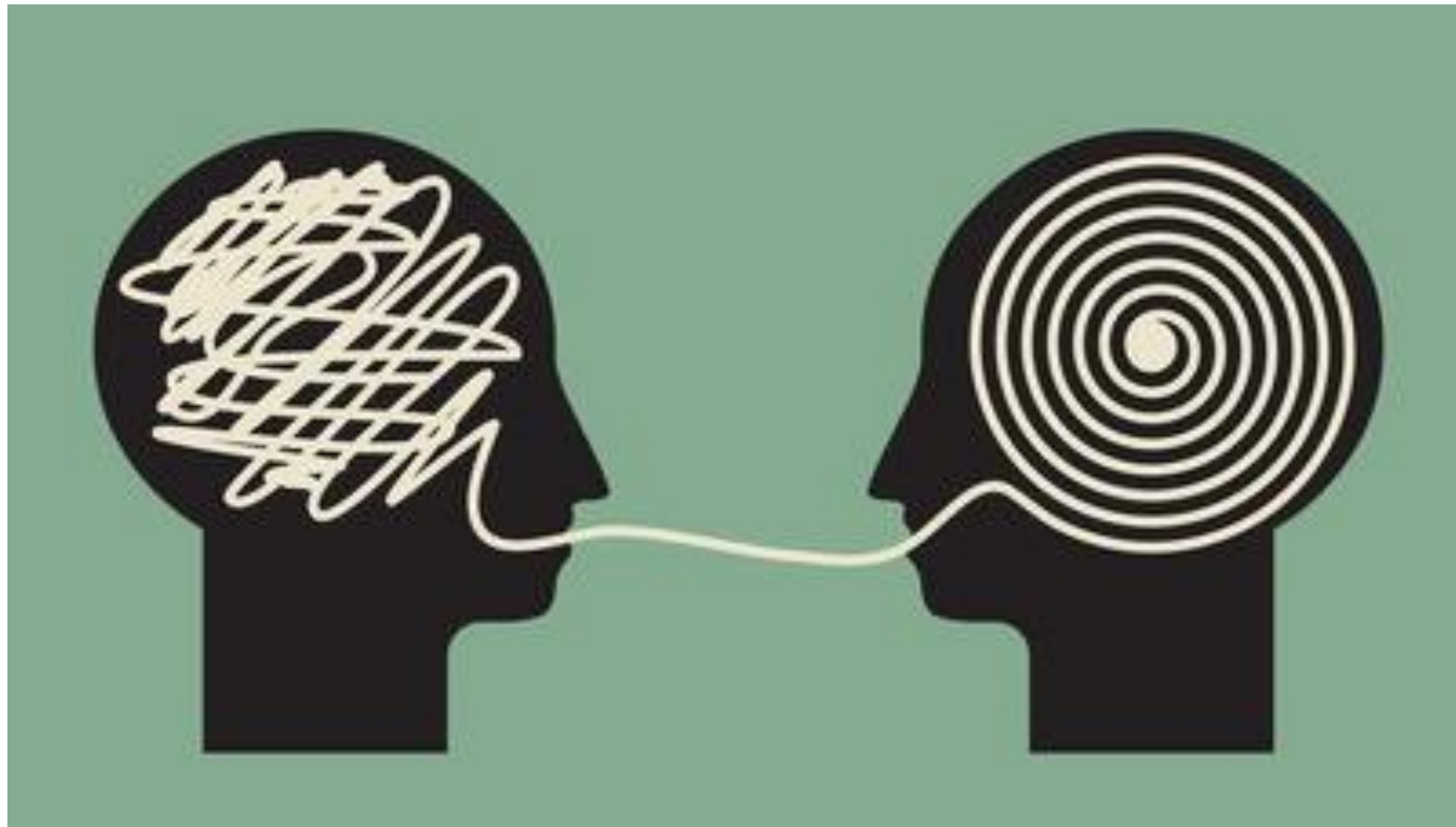


optoprim.fr - optoprim.de - optoprim.it

Dr.- Ing Stefano Zarini

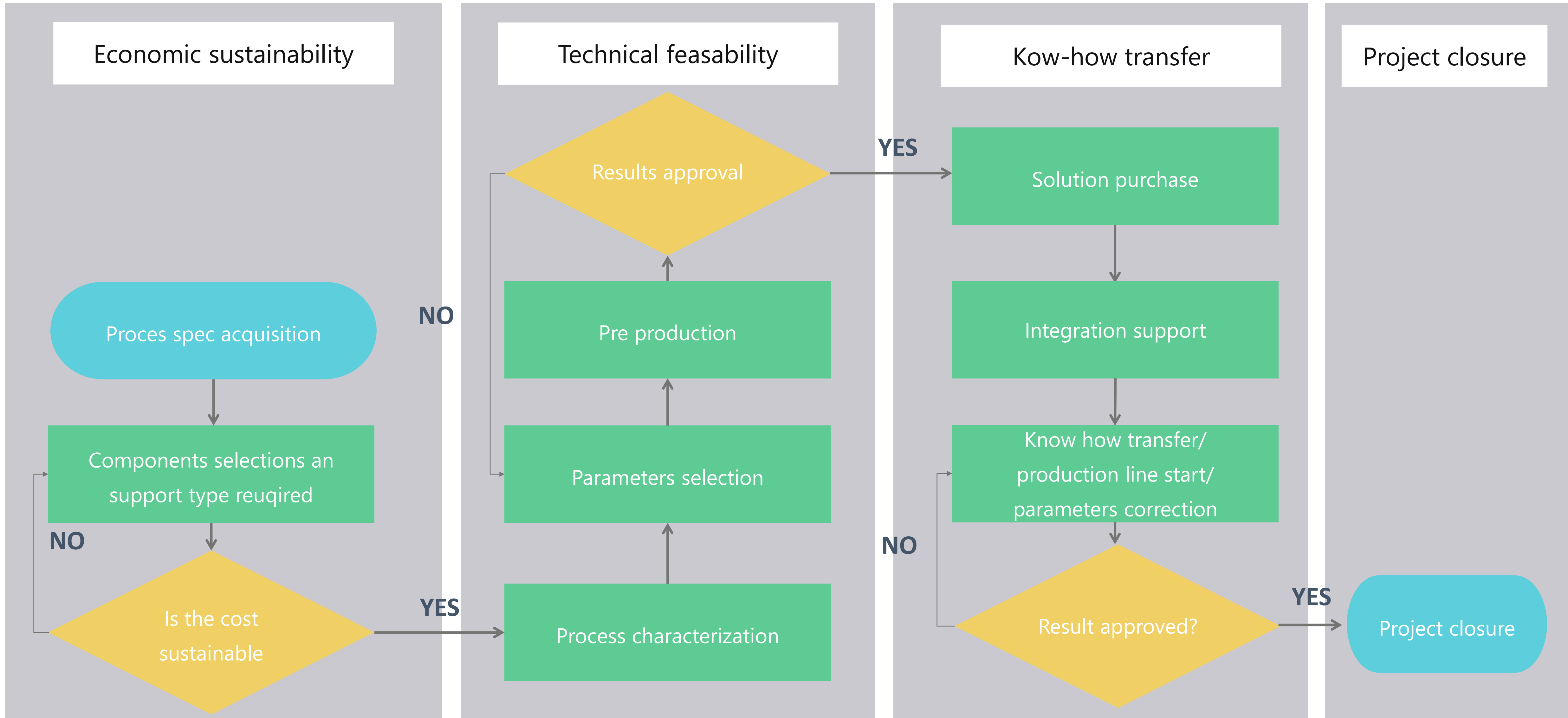
Examples of tailored solution in laser welding: Benefit of single mode lasers in aluminum remote welding

Describe in detail your manufacturing problem



1. What manufacturing laser problem you want to solve.
2. Describe the production environment the problem is located to
3. Give us constrain: Cycle time, Materials, specs...

What we do



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Example of a tailored solution in laser welding

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Context and challenges

CONTEXT



PROBLEM DESCRIPTION/COSTUMER NEED

- Maximization of the working area using scanner because numerous weldings in well defined areas:
Cooling circuit of batteries welding

CHALLENGES

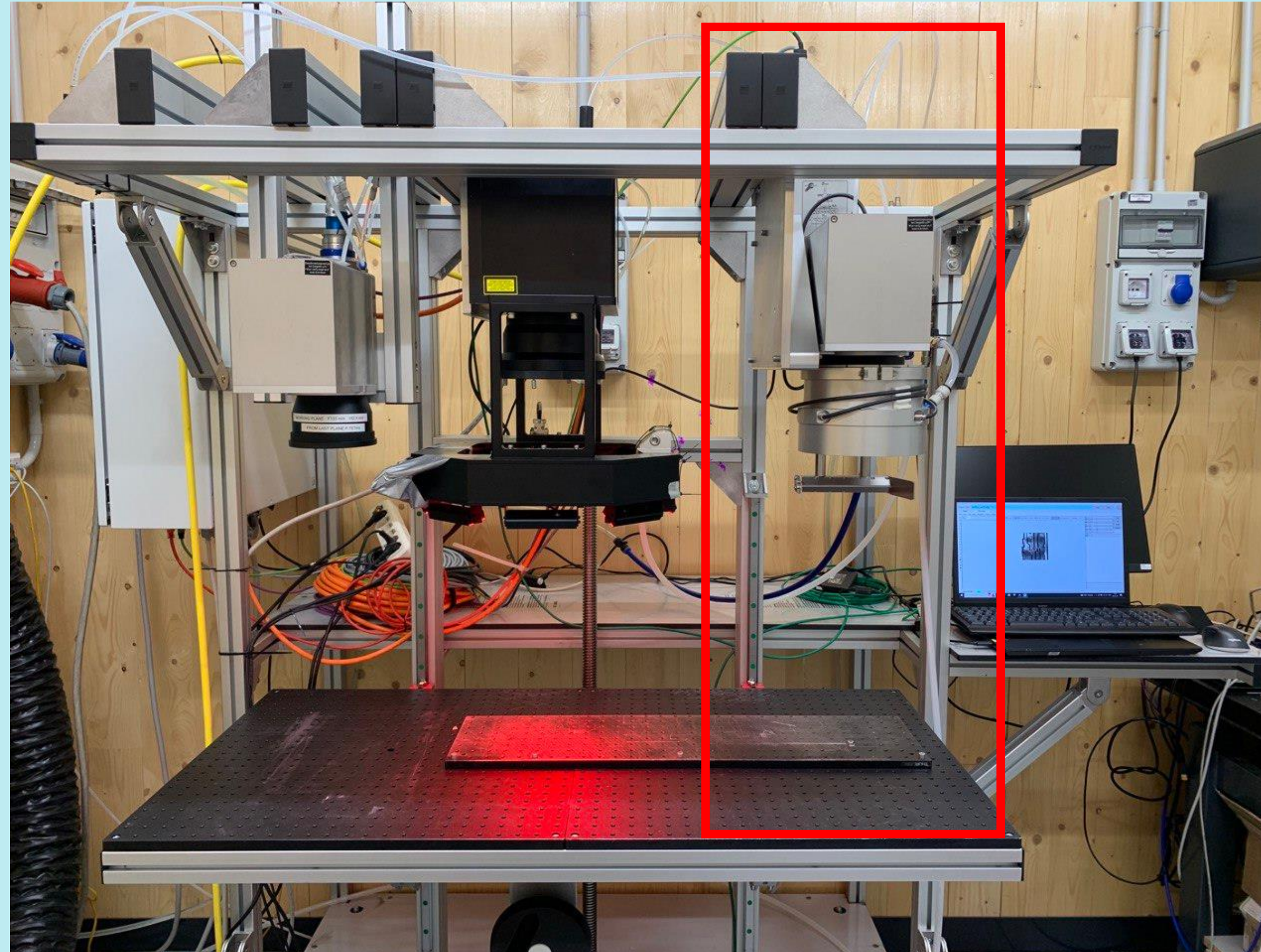
- Aluminum 6xxx series difficult in welding without filler material
- Selection of the correct beam shaping if needed
- High reflective material

SOLUTION TO BE INVESTIGATED

- Oscillating spot
- Fixed spot with and without beam shaping

Set up and process variables

Galvo set Up



Set up and process variables

Fixed spot

Fiber dimension: 100 – 215 – 330 μm
 Laser power: **3000 W**
 Magnification: 2
 Wavelength: 1070 nm

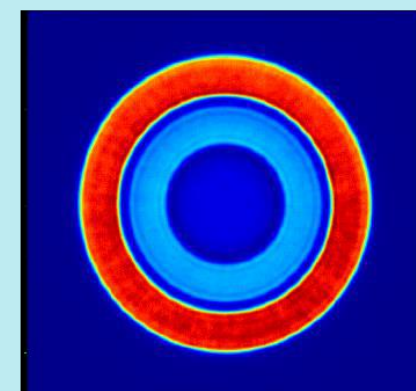
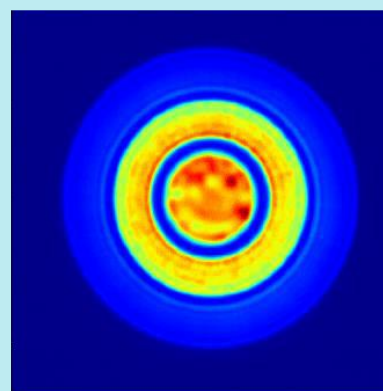
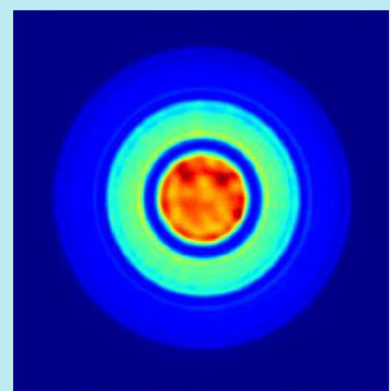
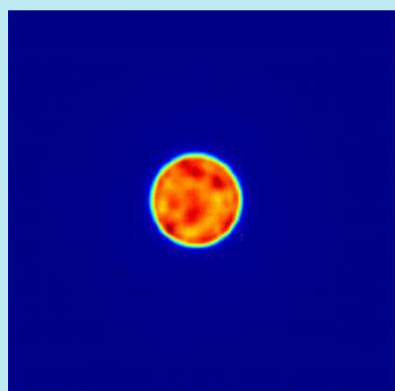
Spot dimension at the work plane

200 μm

430 μm

430 μm

660 μm



Welding speed

2 – 4 – 6 – 8 – 10 – 12 [m/min]

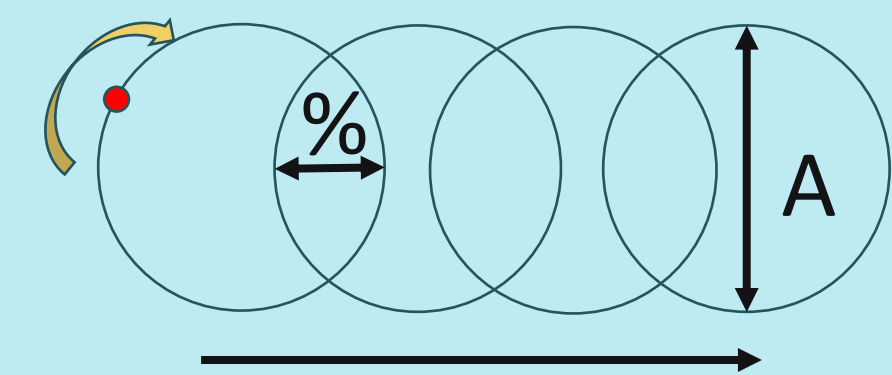
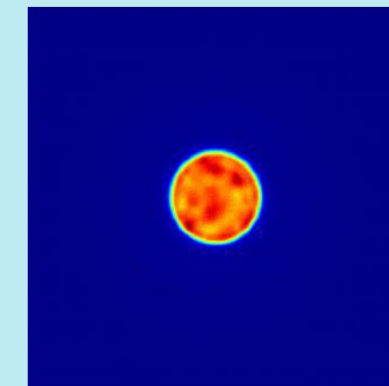
Oscillating spot

Fiber dimension: 50 μm
 Laser power: **3000 W**
 Magnification: 3
 Wavelength: 1070 nm

Spot dimension at the work plane

150 μm

Overlap: 25%/50%/75%



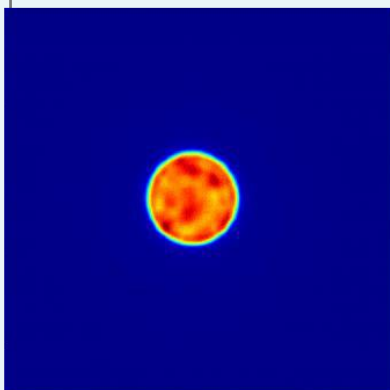
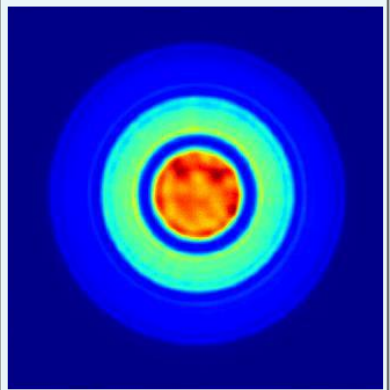
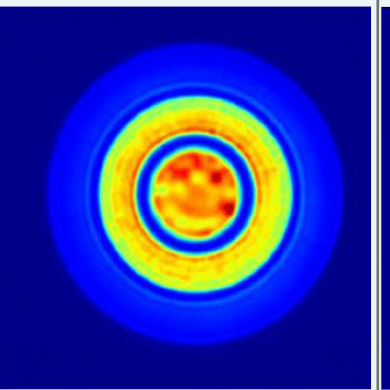
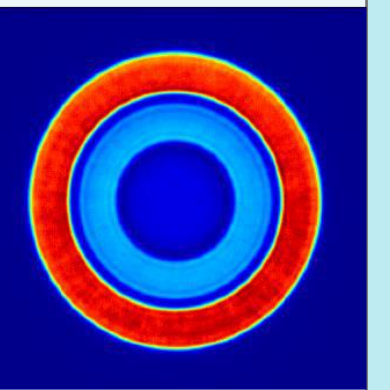
Wobble amplitude: 1 mm
 Max wobbling freq: 300 Hz

Welding speed

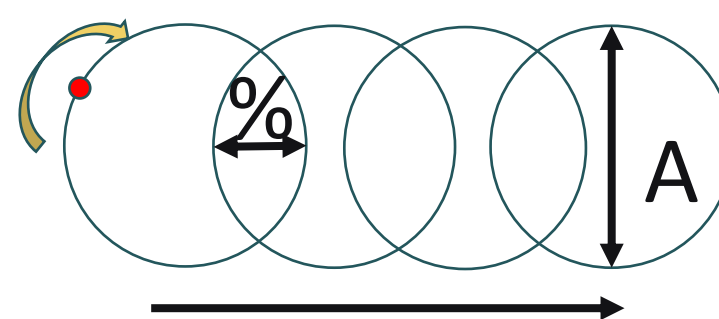
2 – 4 – 6 – 8 – 10 – 12 [m/min]

Results

Fixed spot

					
		200 um	430 um	430 um	660 um
welding speed [m/min]	2				
	4				
	6				
	8				
	10				
	12				

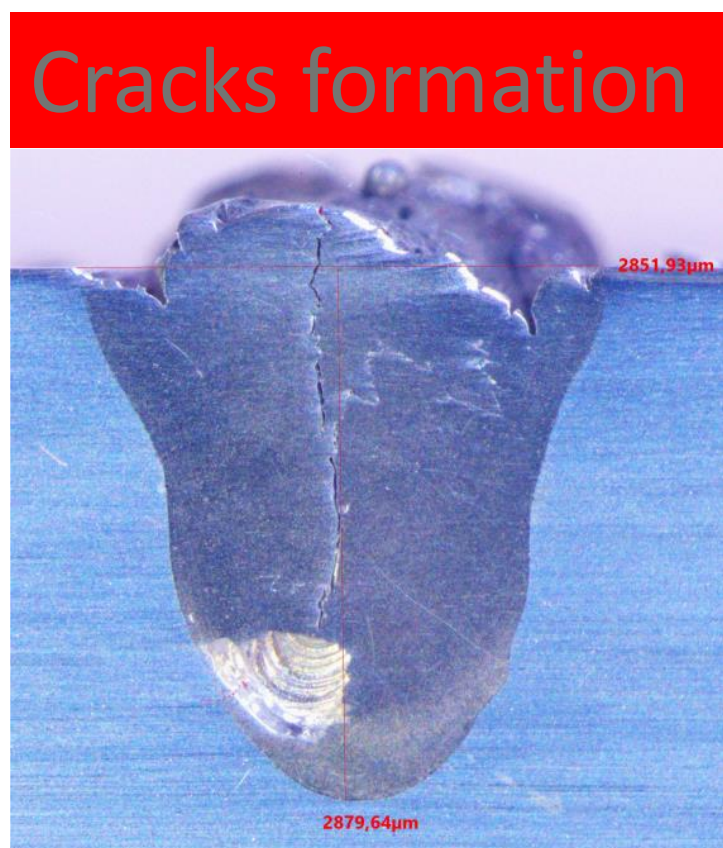
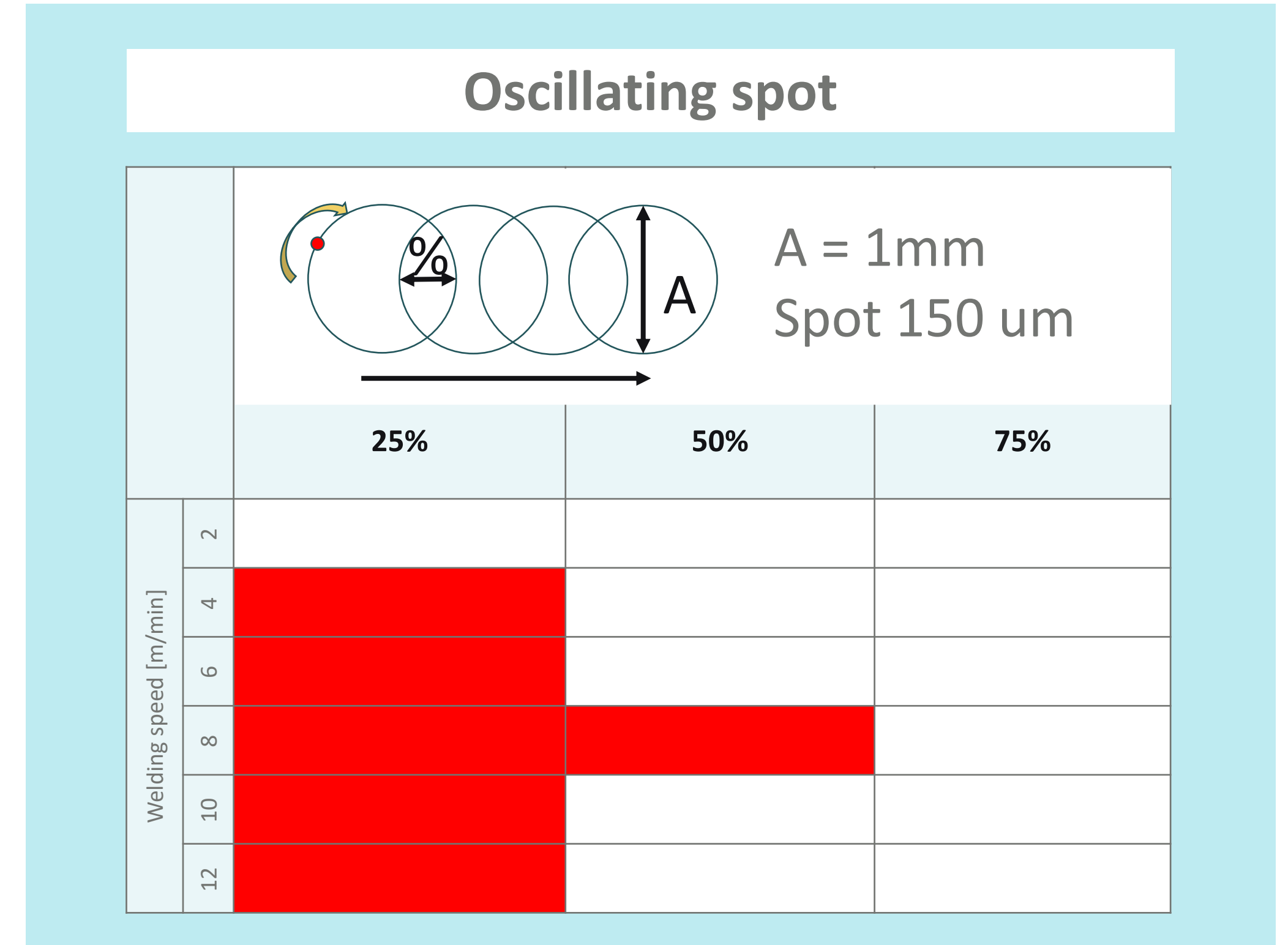
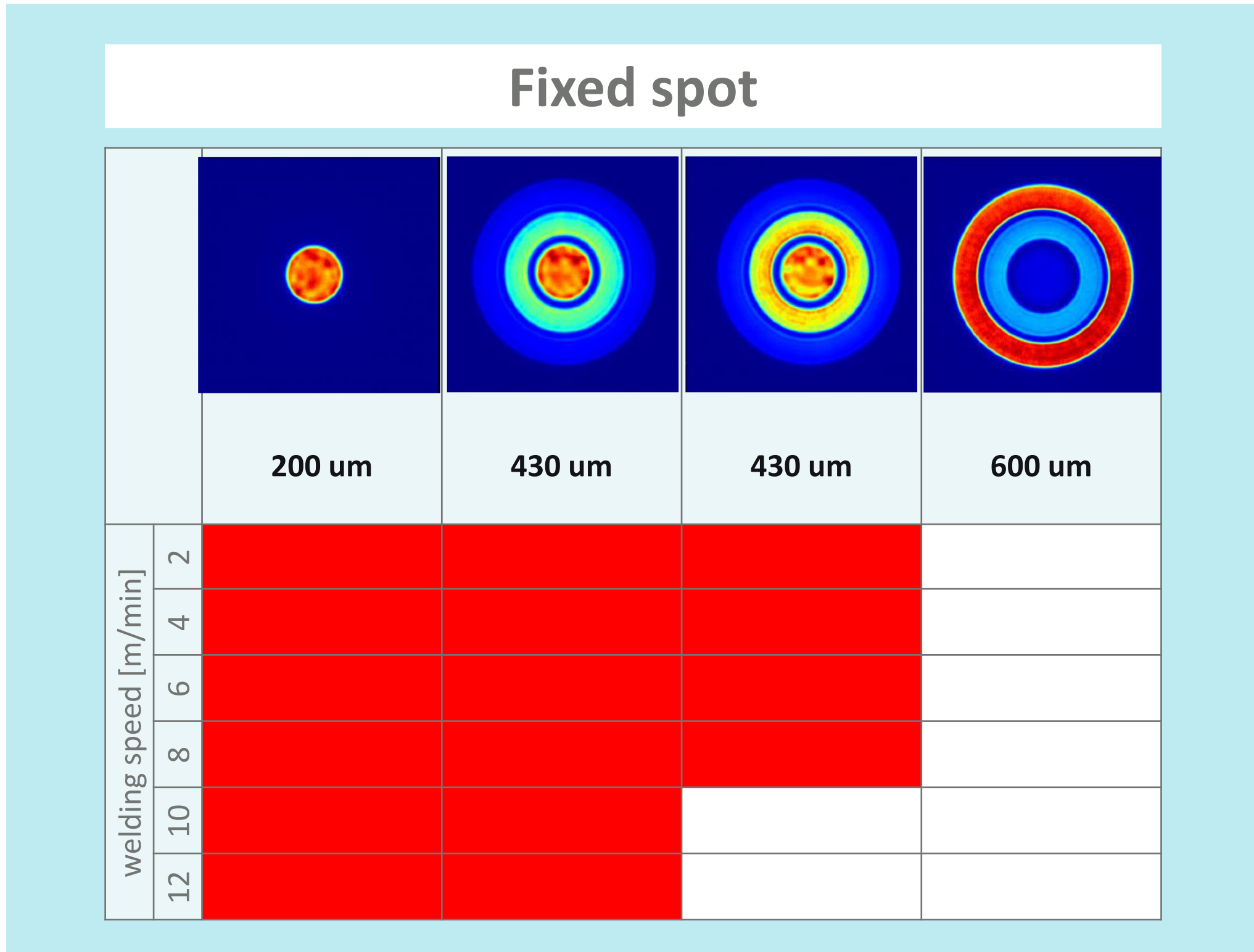
Oscillating spot



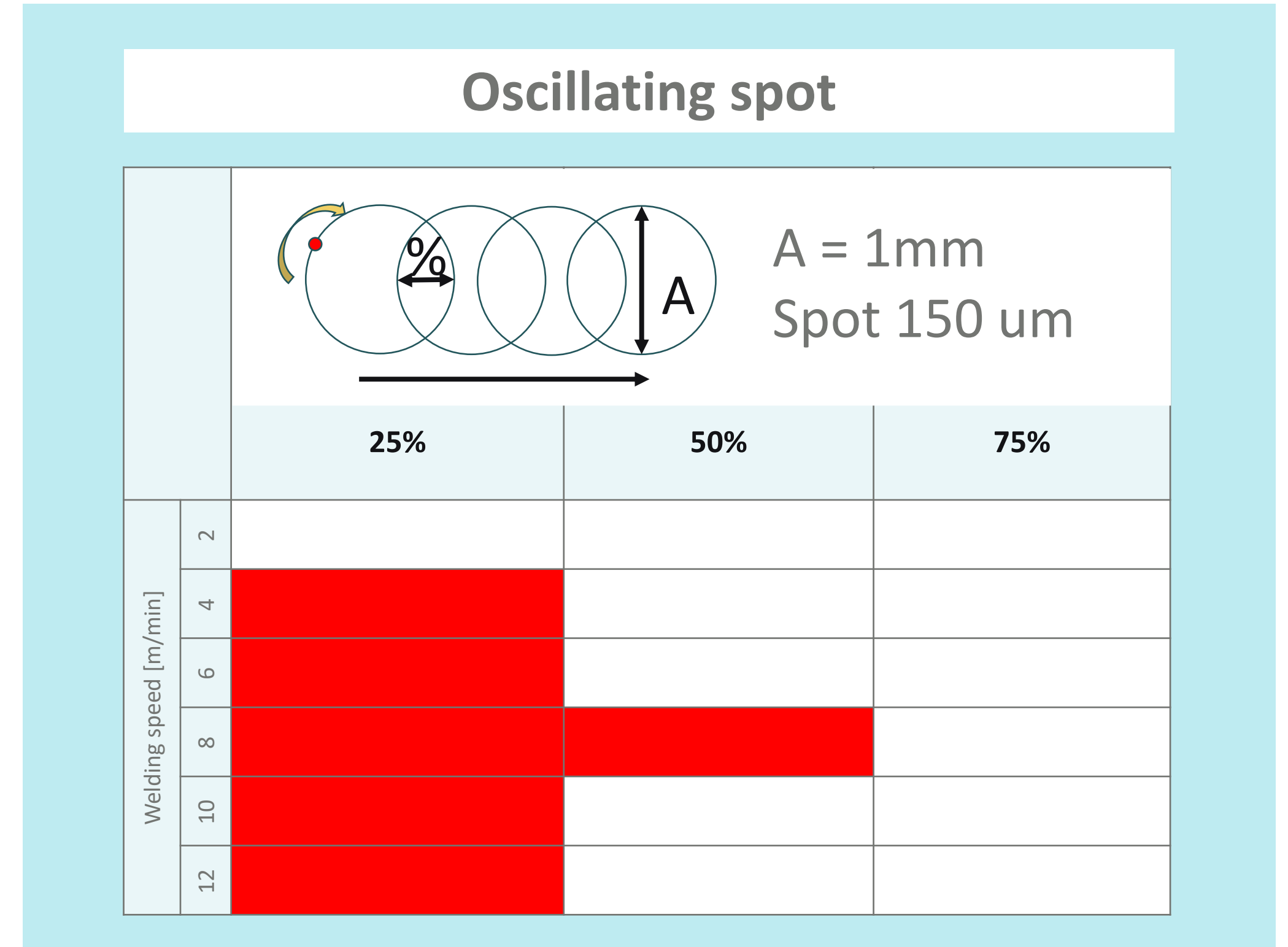
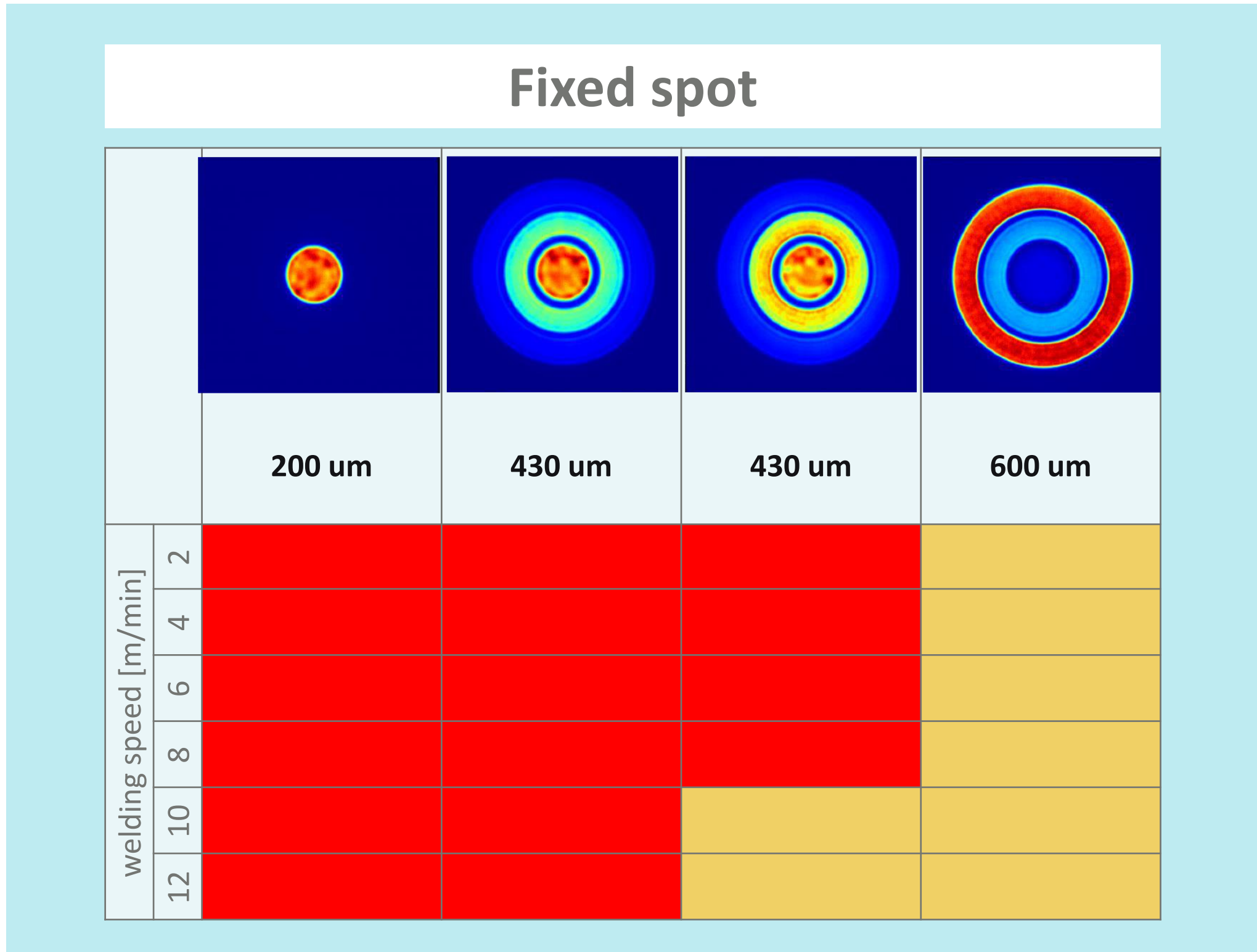
A = 1mm
Spot 150 um

		25%	50%	75%
Welding speed [m/min]	2			
	4			
	6			
	8			
	10			
	12			

Results



Results

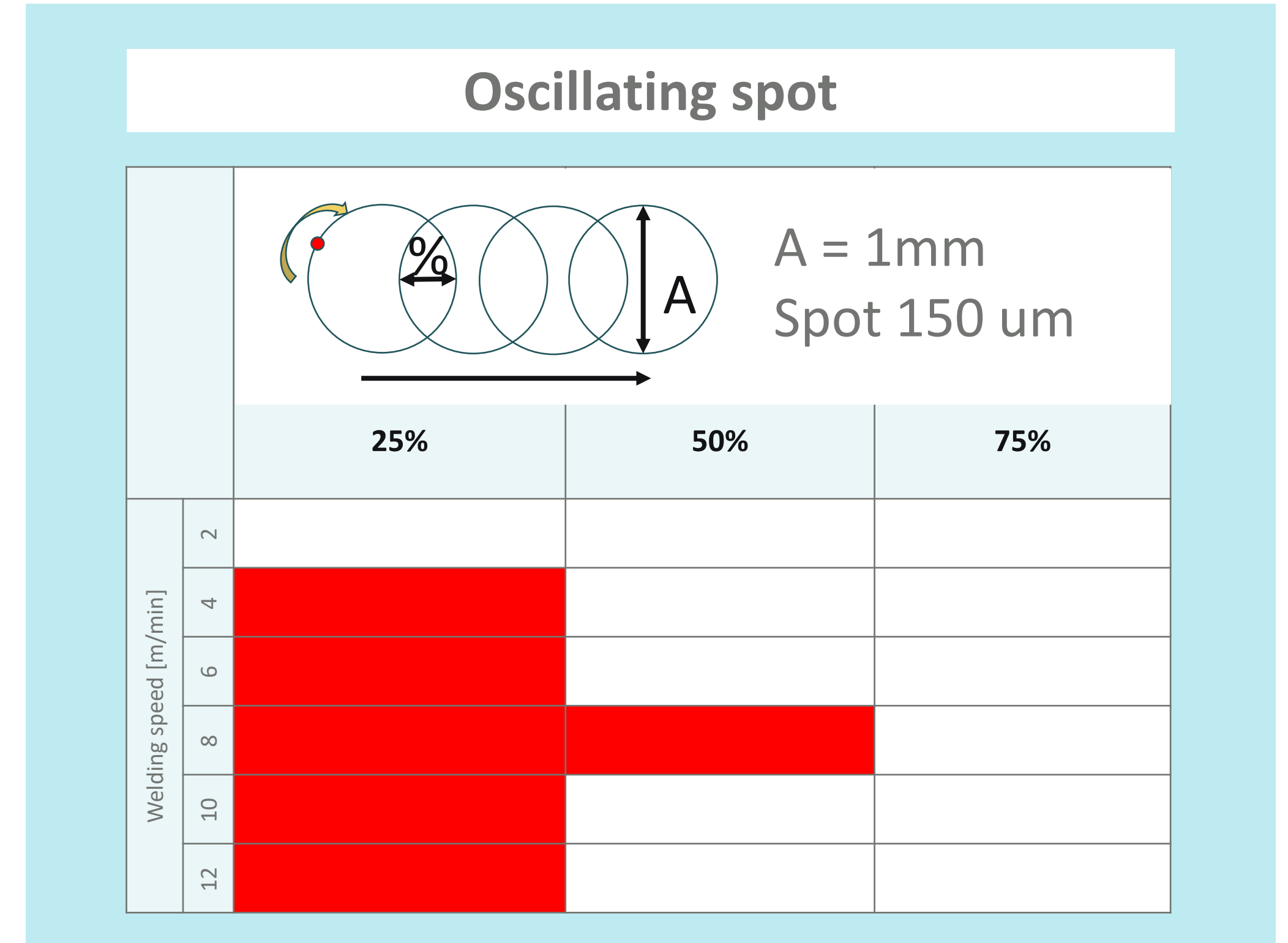
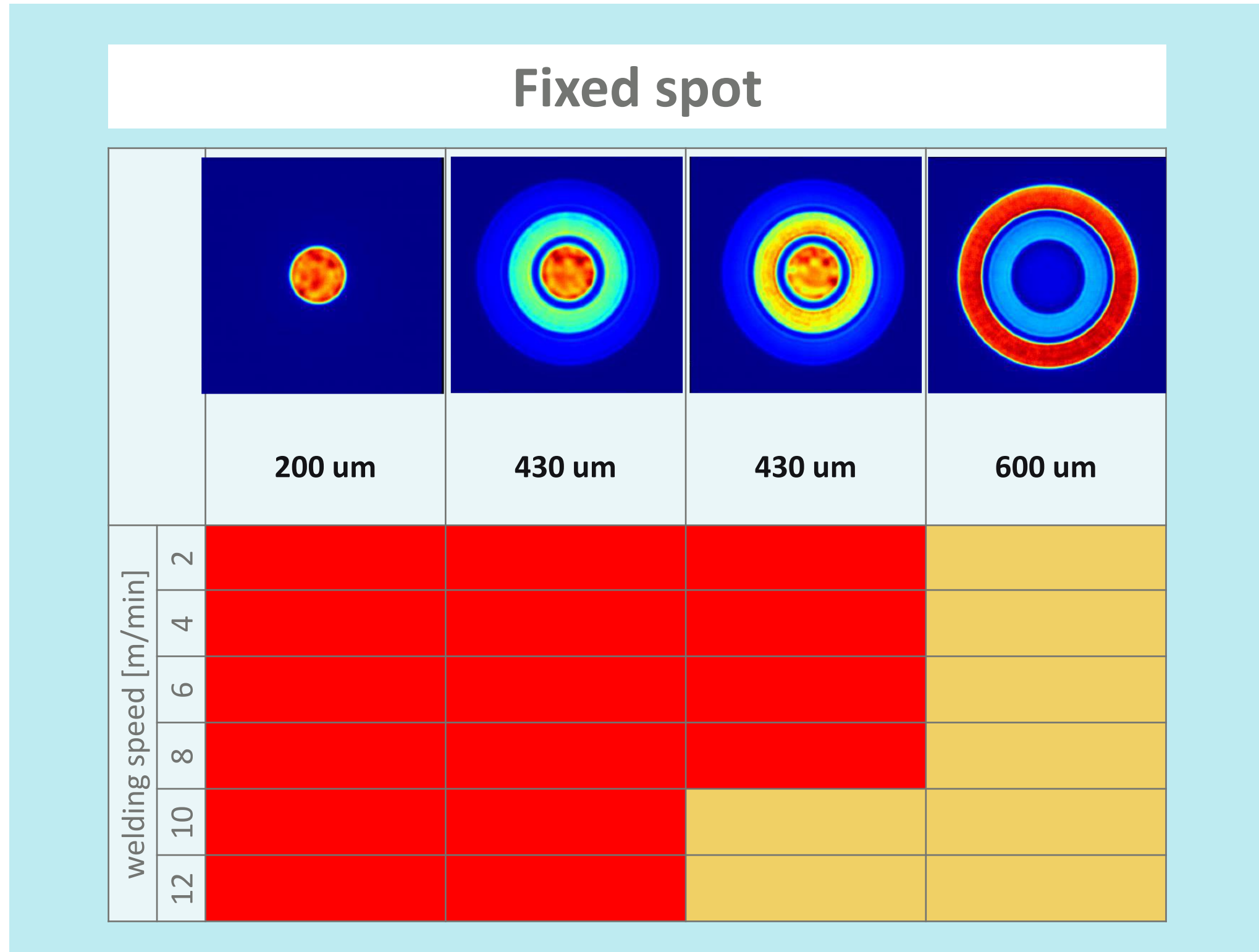


Cracks formation



No welding

Results

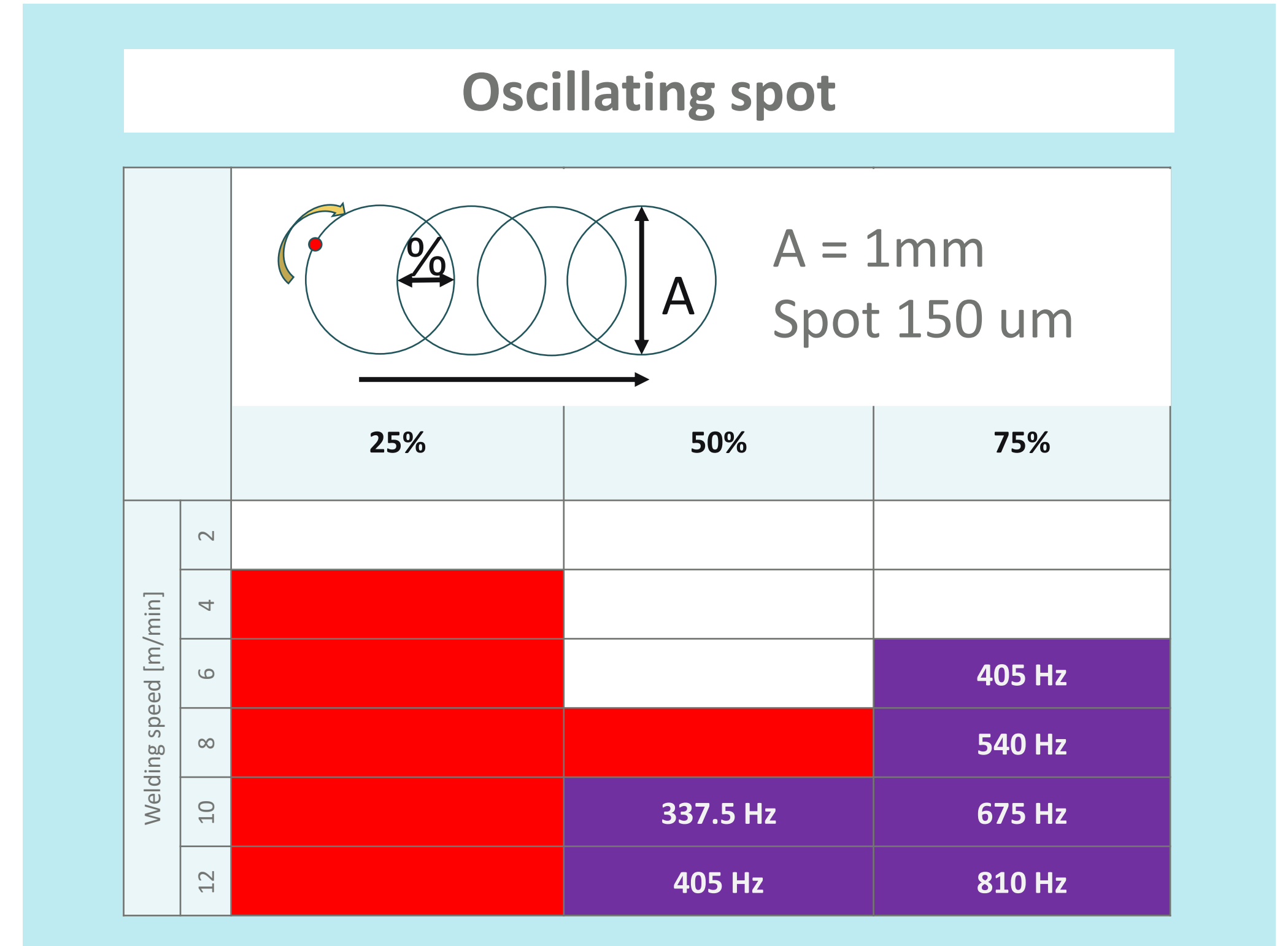
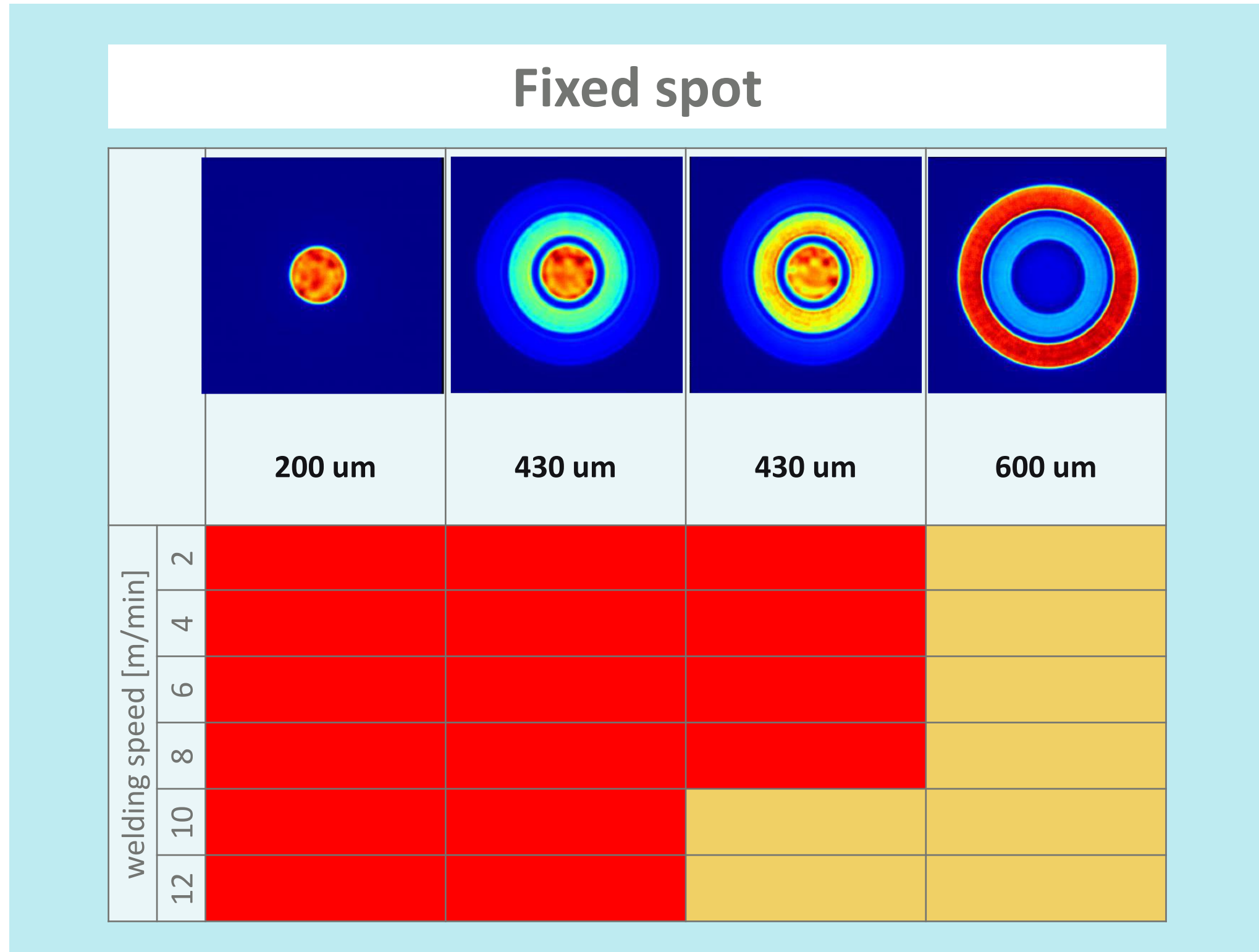


Cracks formation



No welding

Results



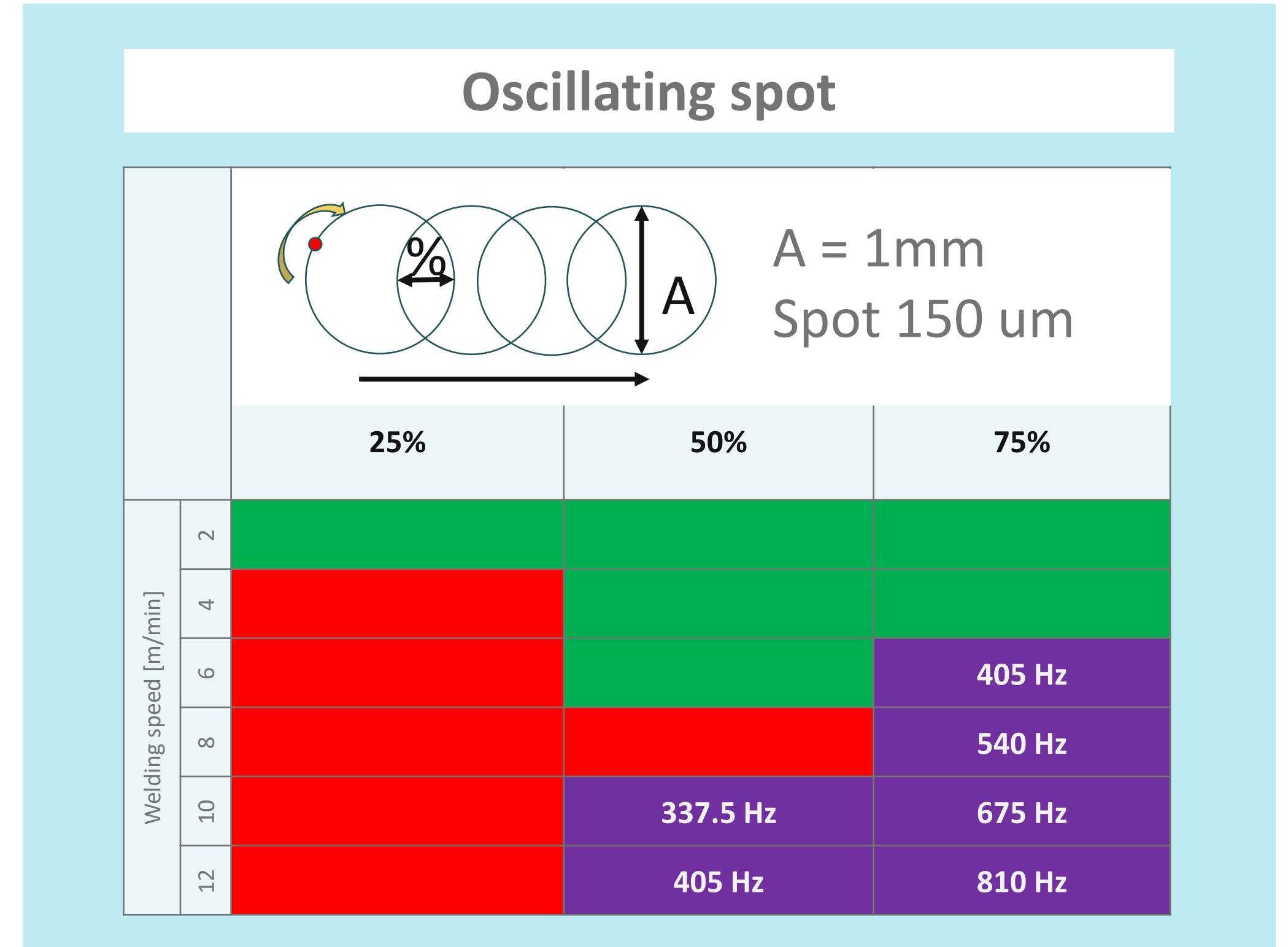
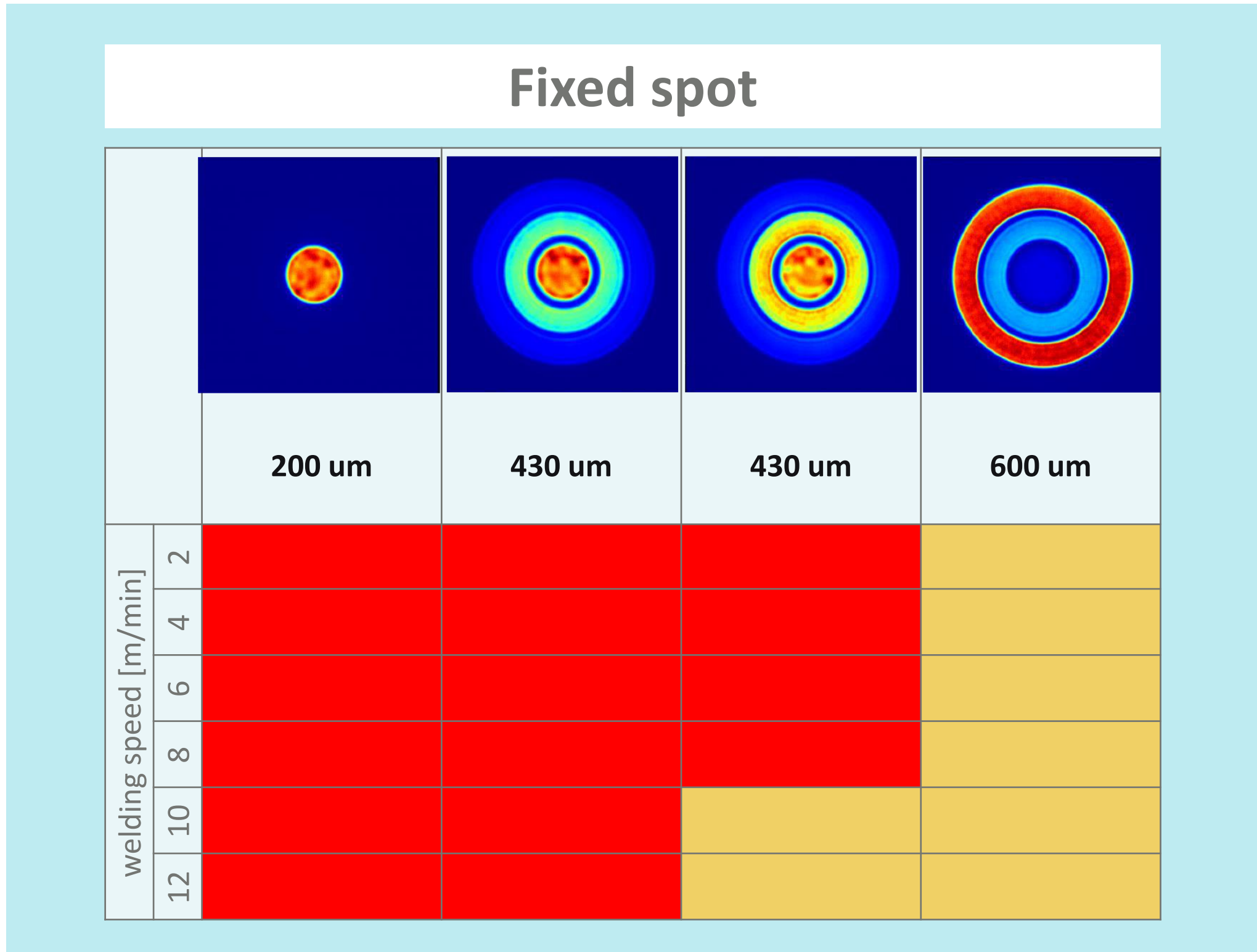
Cracks formation



No welding

Scanner freq. limit

Results



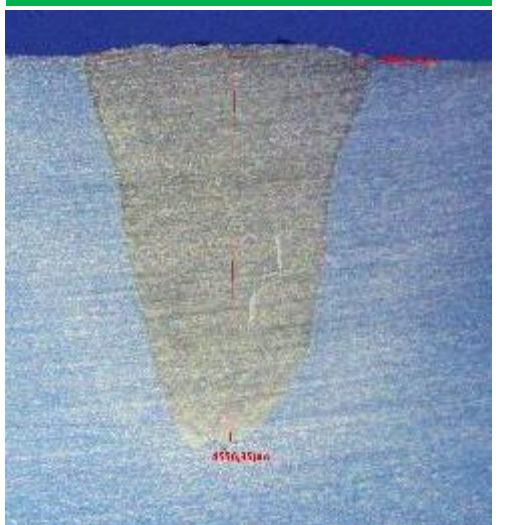
Cracks formation



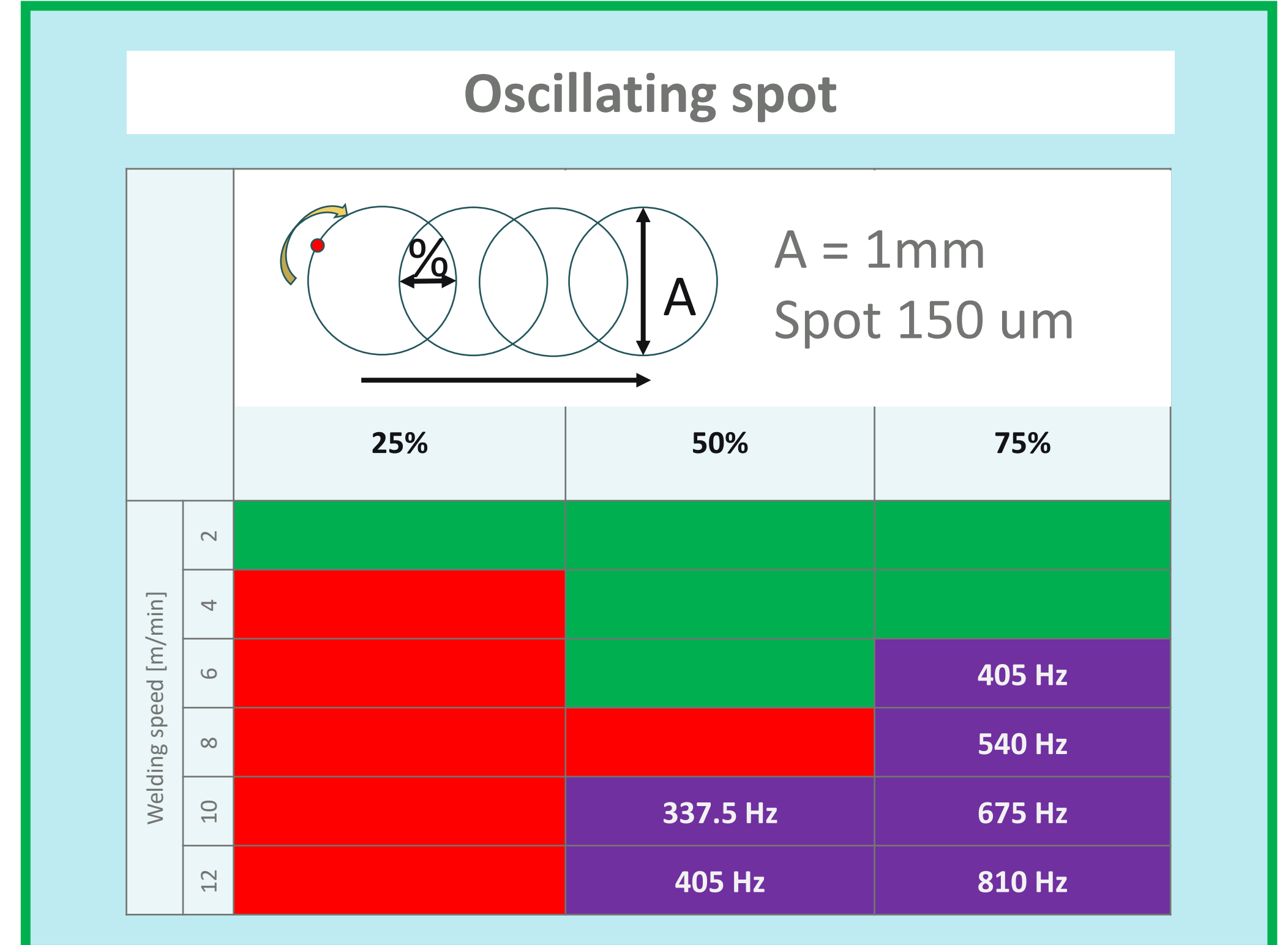
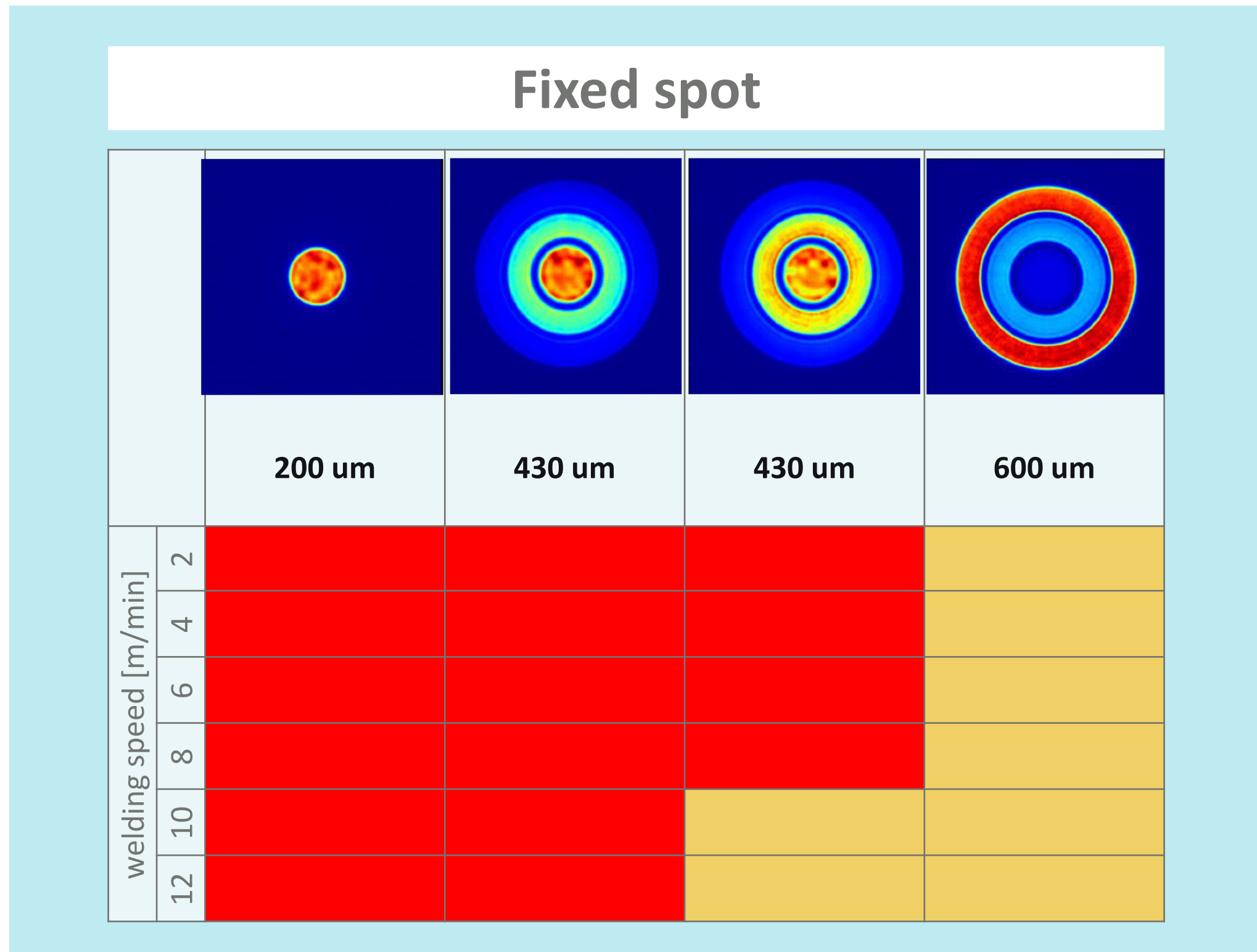
No welding

Scanner freq. limit

OK



Results



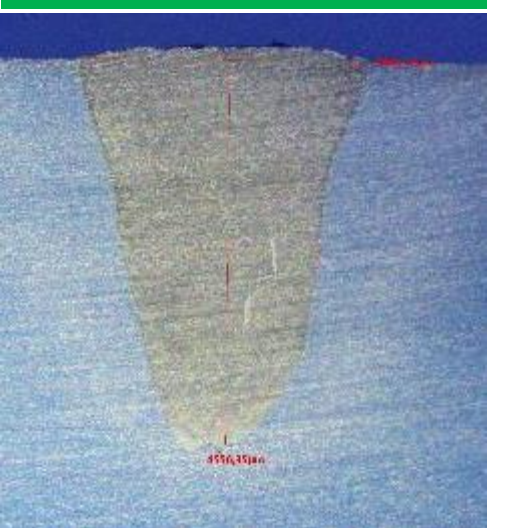
Cracks formation



No welding

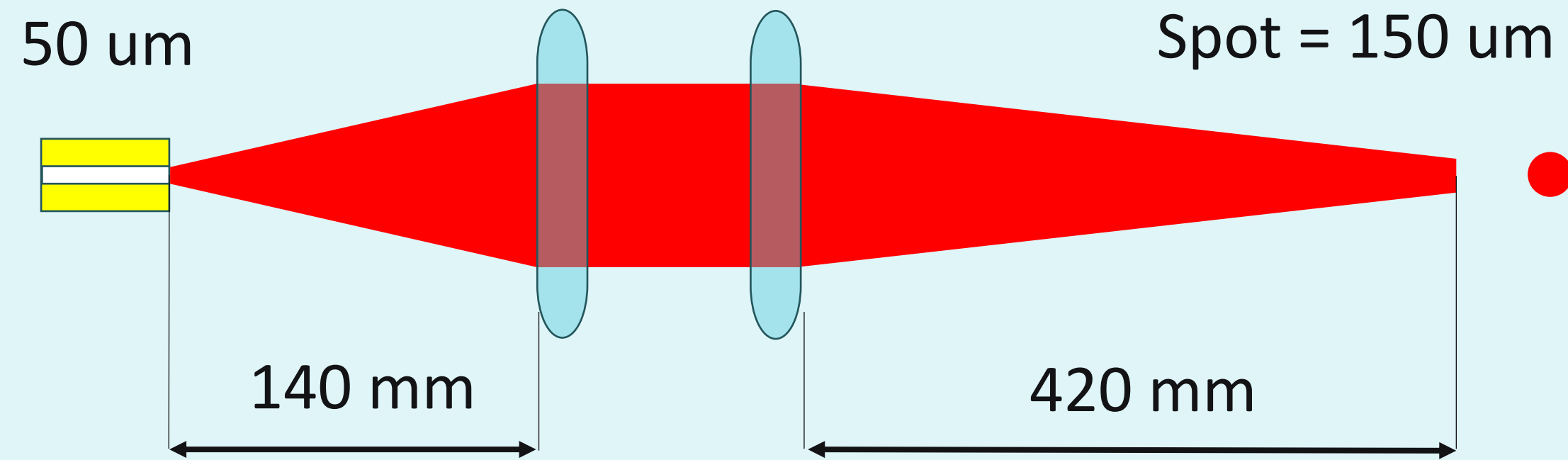
Scanner freq. limit

OK

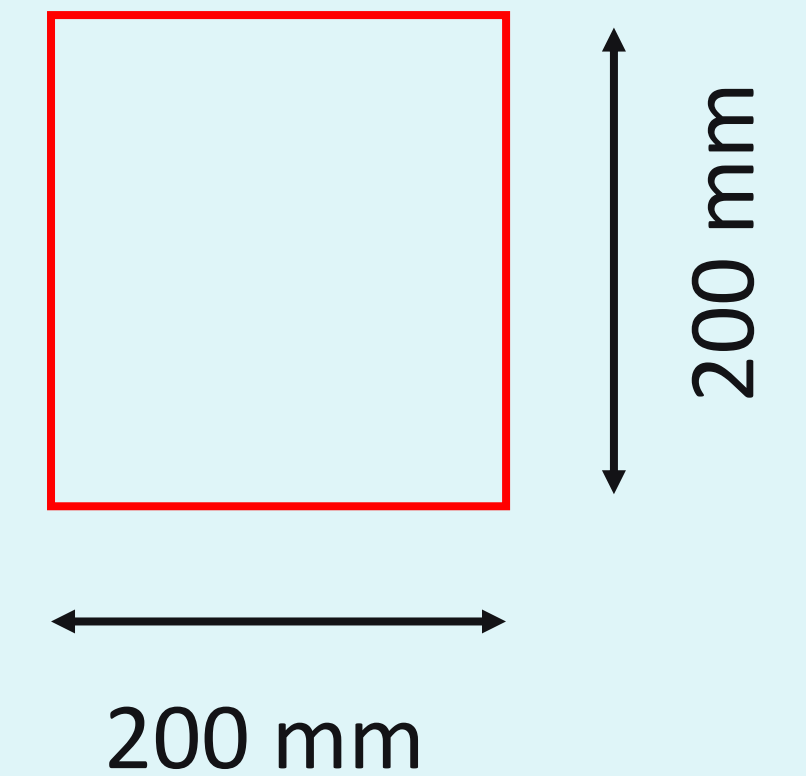


Results

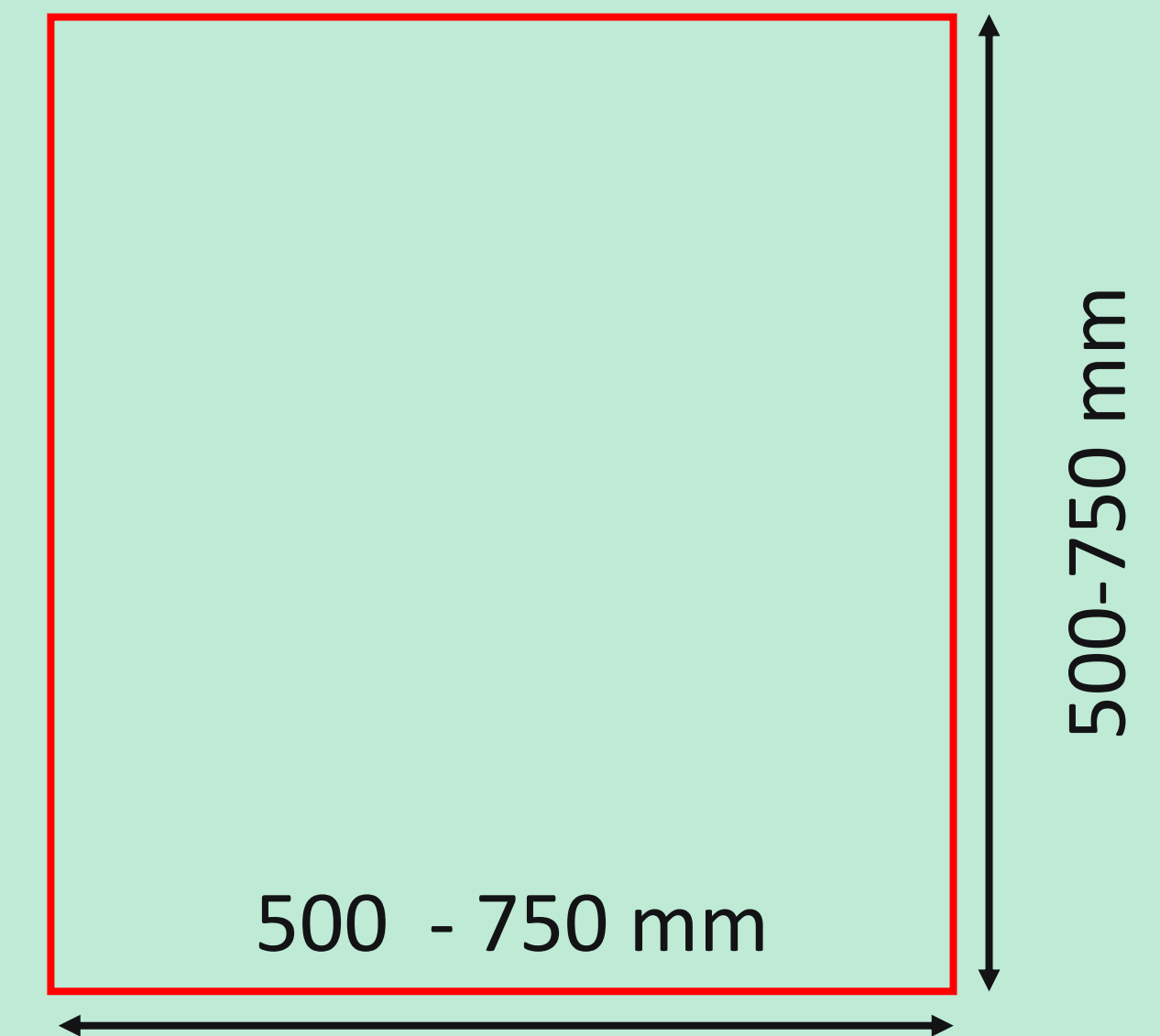
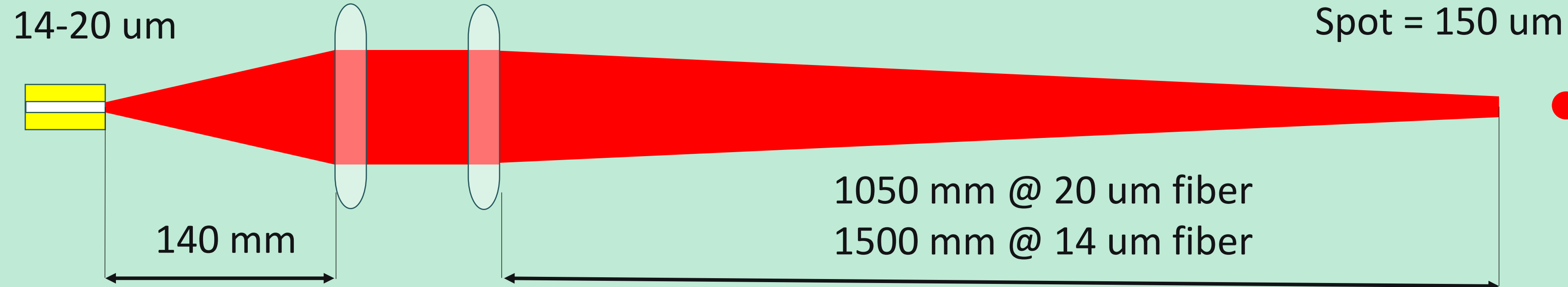
Identified solution



Typical Working area in scanners



Working area maximization



Conclusions

- Stand alone beam shaping is not a solution to welding Al6xxx series. Cracks are left in the welding;
- Oscillating beam, in some specified condition, can be a solution to obtain crack free welding of Al 6xxx series
- The key is getting small diameter and stirring it at relatively high frequency
- Once identified the spot dimension and process condition that allow to get good welding results, the working area maximization is obtained reducing as much as possible the fiber diameter in order to elongate the f-theta length
- **The further benefit of this configuration is the increase of the Relay length that passes from 2.6 mm to 33. 2 mm that lead the process to be much less susceptible work plane deviation.**

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- Examples of tailored solutions customer oriented were presented
- A standard methodology was used to address each specific problem based on the following point:
 - Problem comprehension and industrial context analysis
 - Subsequent solution selection according to the best obtained result

Benefit of single mode lasers in aluminum 6xxx series remote welding

- Identification of stable process parameters for welding of 6xxx series using NIR wobbling strategies was assessed
- Benefit of identified process parameters transferred to single mode laser was assessed

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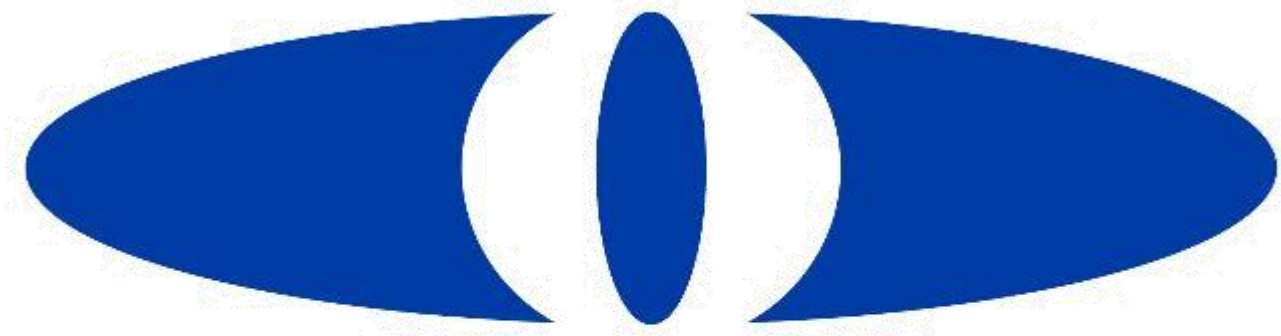
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