

Automobilkonferenz 2019 „Joining – Smart Technologies“  
08.Mai 2019, Sattledt, AUT

# The smart arc

## Thermal joining in the modern car body manufacture

Dr. Christian Kotschote



# AGENDA

» Field of application

» Topics of development

» The objective

» Digital approaches

» The smart arc

» Summary



# AGENDA

## » Field of application

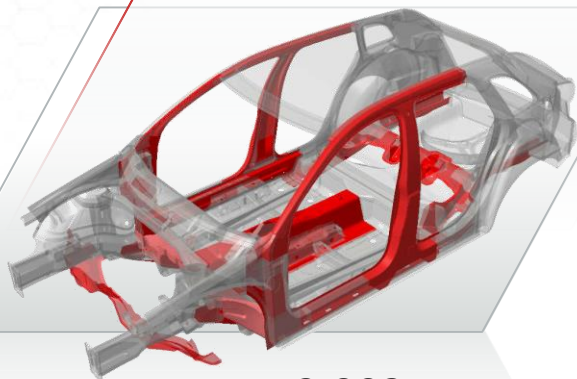
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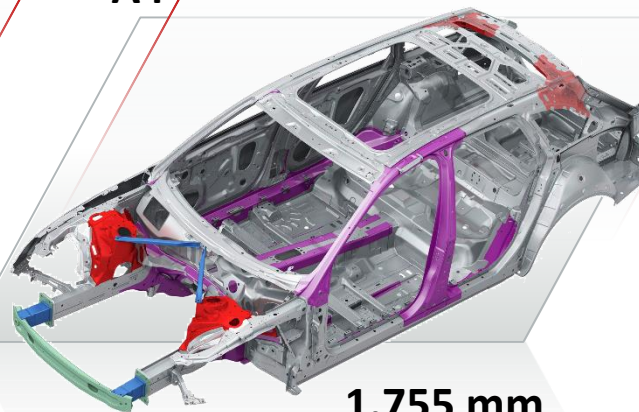
## Field of application

**A3**



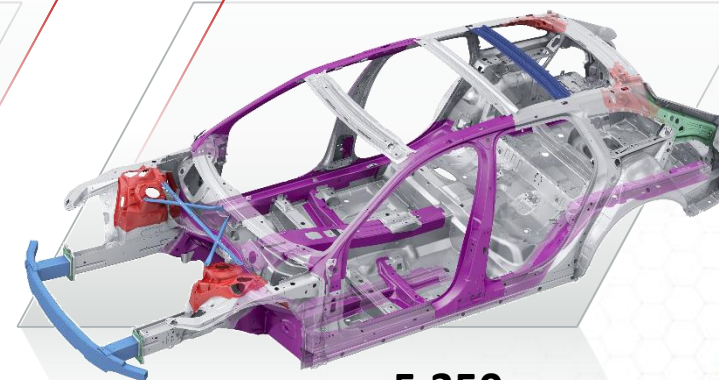
**2.903 mm**

**A4**



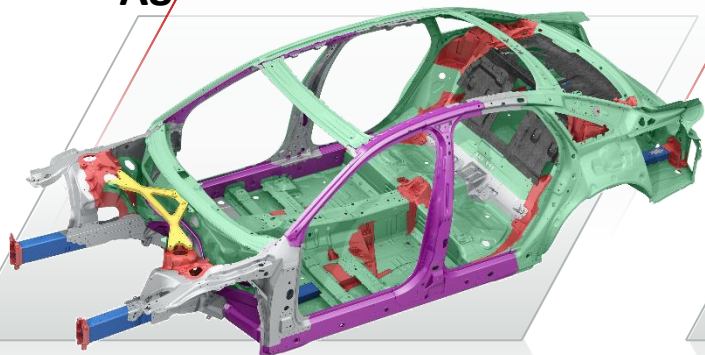
**1.755 mm**

**A6**



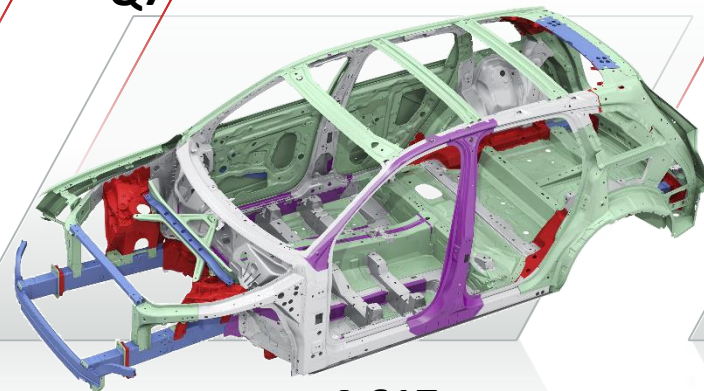
**5.350 mm**

**A8**



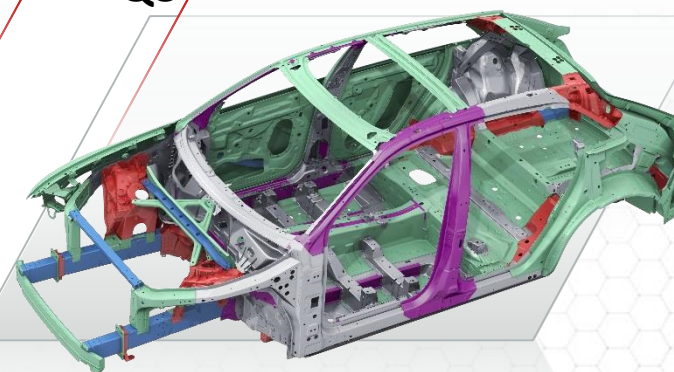
**6.703 mm**

**Q7**



**4.617 mm**

**Q8**



**4.737 mm**

# AGENDA

» Topics of development





## Topic of development

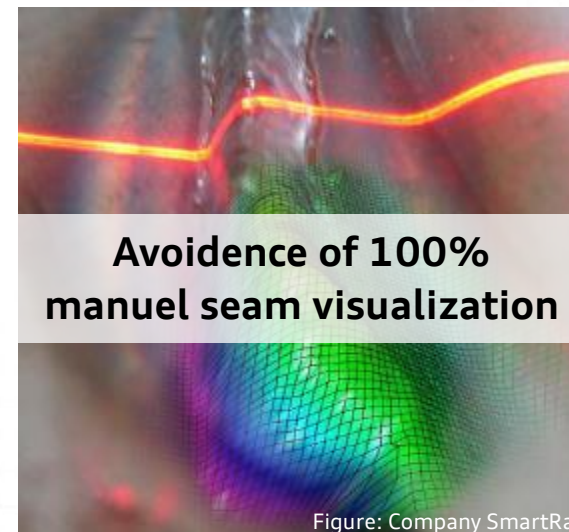
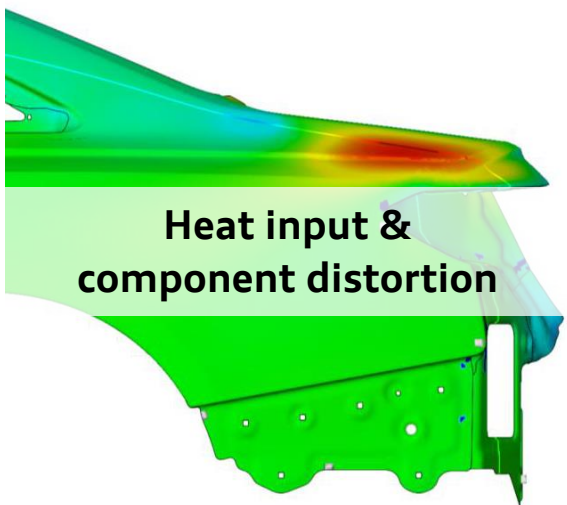
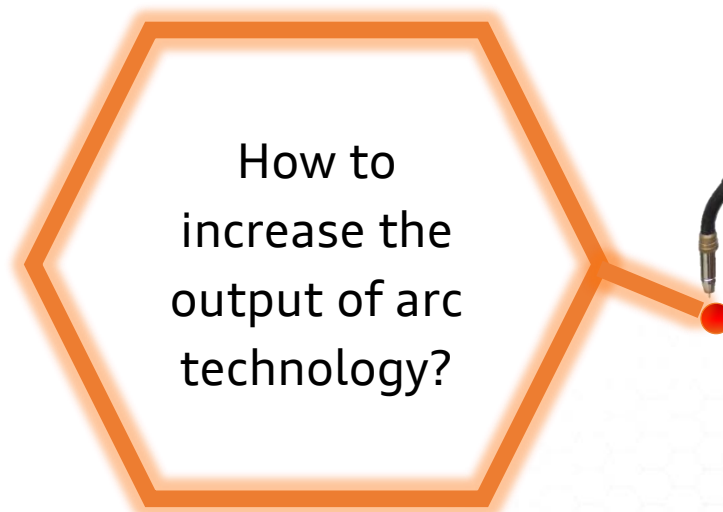
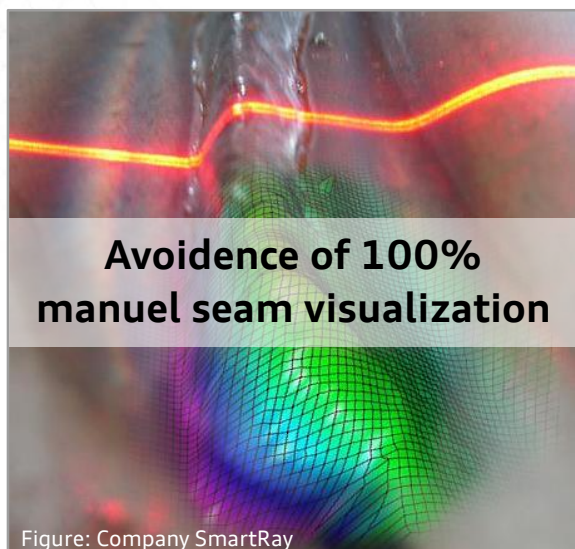


Figure: Company SmartRay

## Manual seam visualization



### Cost fraction

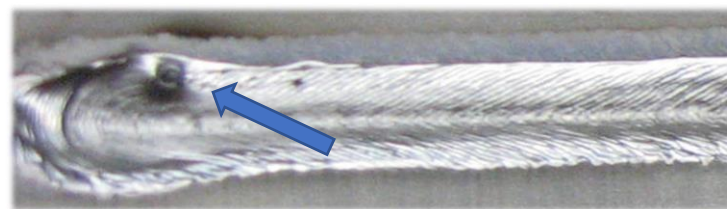


Wire - 18%

Gas - 10%

Current - 1%

Visualization - 71%



Example MIG welding

# AGENDA

» **The objective**





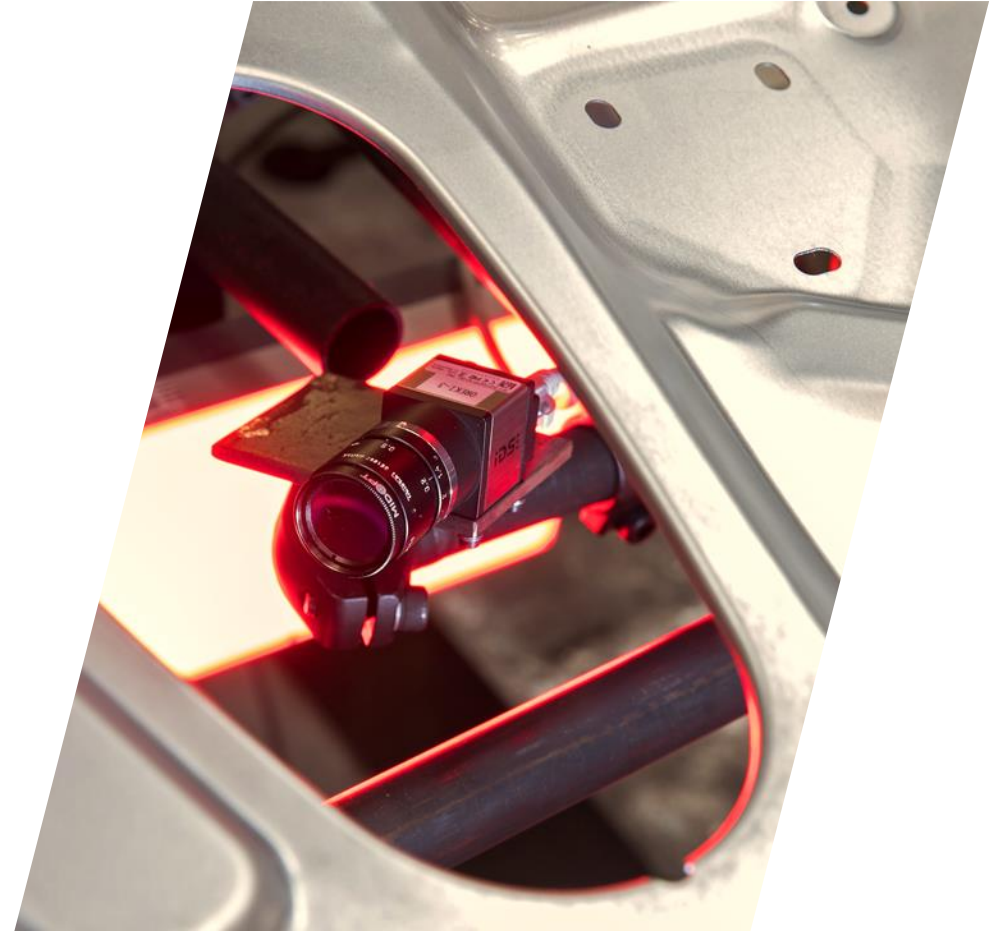
The background is a dark, abstract composition featuring a network of glowing orange and yellow lines that intersect and curve across the frame. Scattered throughout this network are numerous numbers in white and orange, some appearing as if they are floating or falling. On the right side, a robotic arm with an orange upper section and a black lower section is visible, its end effector pointing towards the center of the image. A bright orange line extends from the text box towards the robotic arm's tip, ending in a small red dot.

**Using of all relevant informations  
across the total process chain!**



# AGENDA

» Digital approaches



# Process chain of GMAW

Pre +



Pre



In



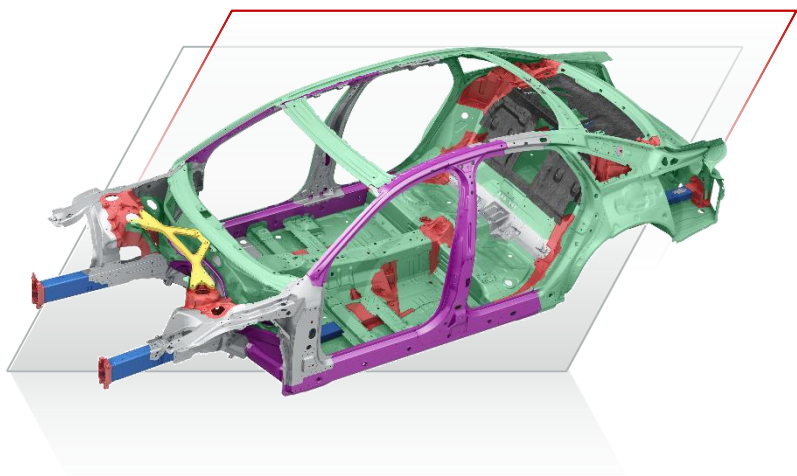
Post





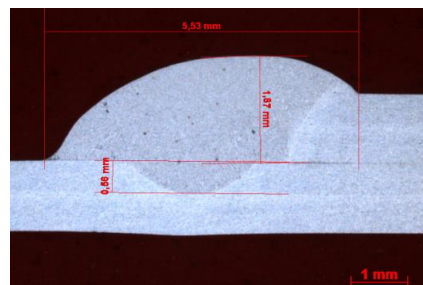
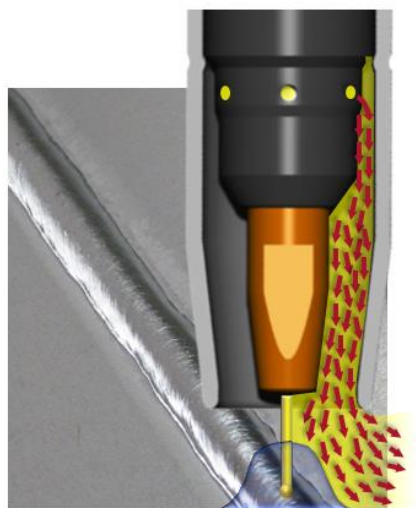
## Automated seam tracking

- › Car: *Audi A8*
- › Plant: *Neckarsulm*
- › Application: *water channel*

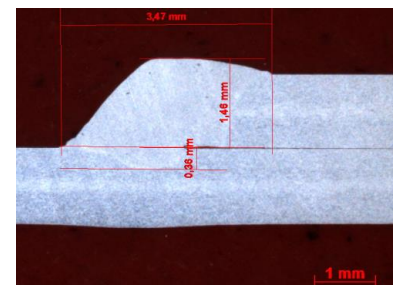
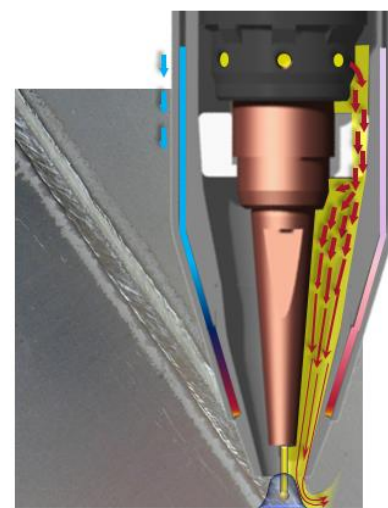


## Aluminum-CMT-Welding

*conventional*



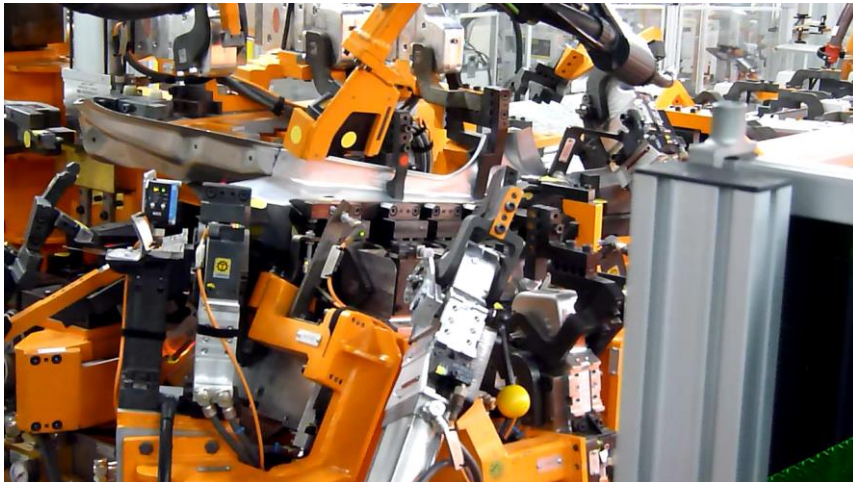
*modified*



Company VMT BK

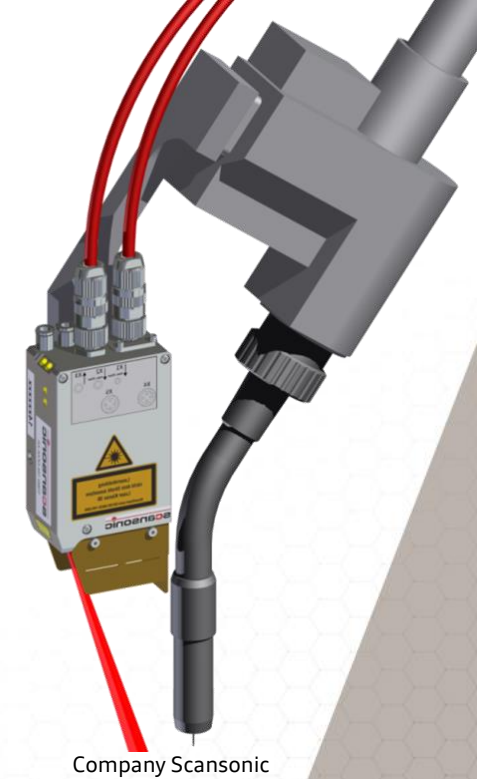
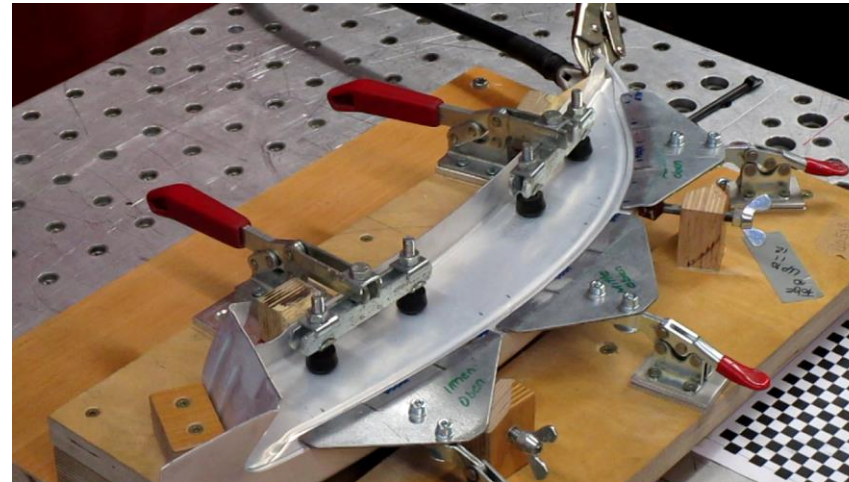
### ... from Offline

- › Point measurement
- › Enables optimal position for measuring
- › Measurement needs an additional process



### ... to Online

- › Line measurement
- › No additional process step necessary
- › Interfering contour due to leading sensor





## Smart process equipment

- › Processes & characteristic curves
- › Weld properties
  - › Splatter Free Ignition (SFI)
- › Assistance & control stabilizers
  - › Weld penetration
  - › Arc length

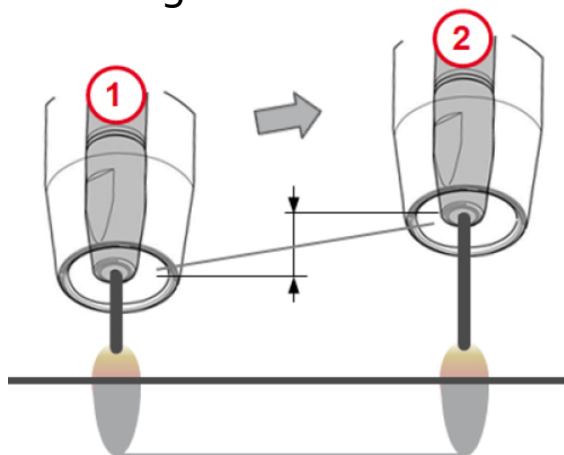
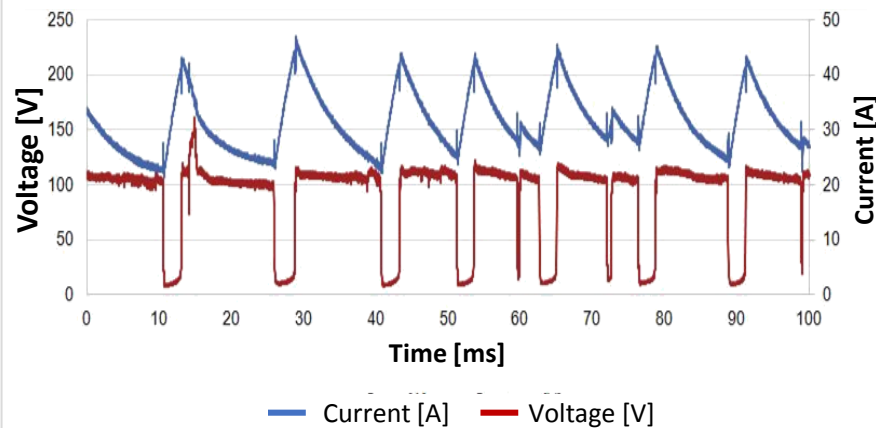


Figure: Fa. Fronius

## Internal process control

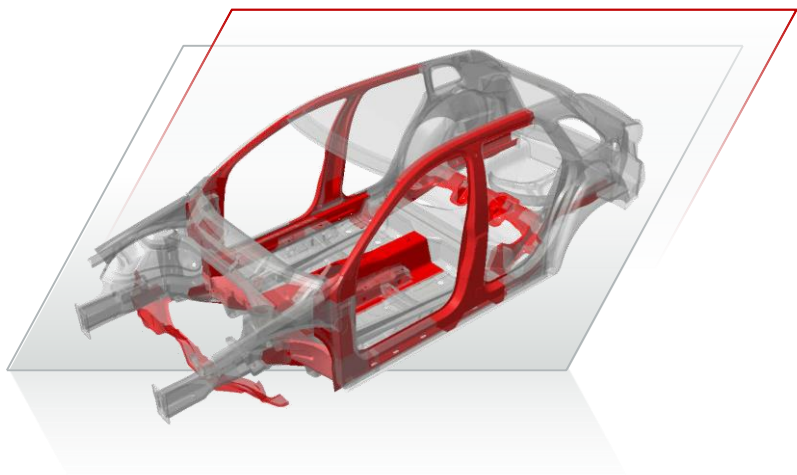
- › Example I/U-Analysis
- › Current-Voltage-Analysis
- › Fast reaction to welding defects





## Automated seam visualization

- › Project: *Audi A3*
- › Plant: *Ingolstadt*
- › Application: *Frame rail, door*



## Example @ Audi A3

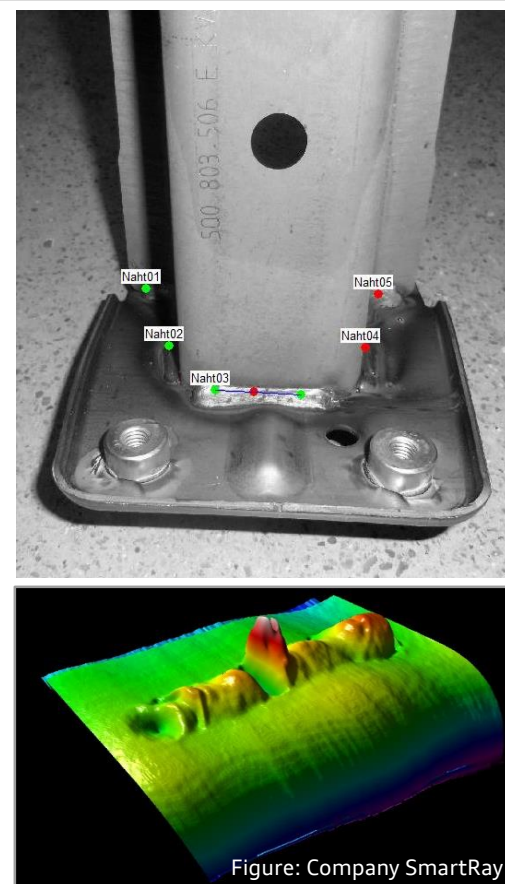
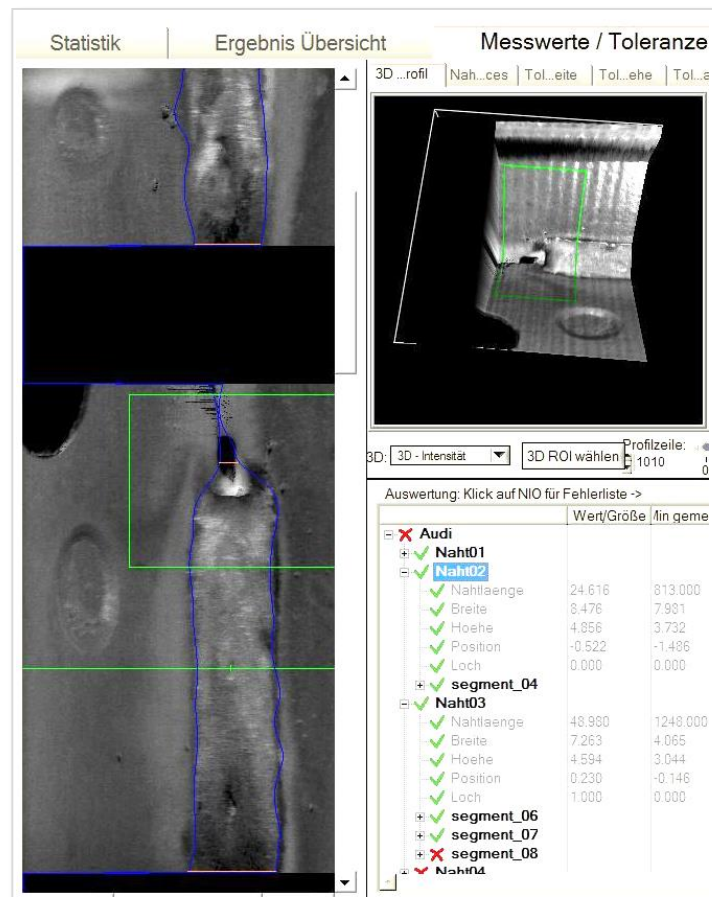


Figure: Company SmartRay

## Process chain of GMAW

Pre +

Pre

In

Post

- › Many digital approaches available
- › High complexity
- › One System is not enough

# AGENDA

» The smart arc



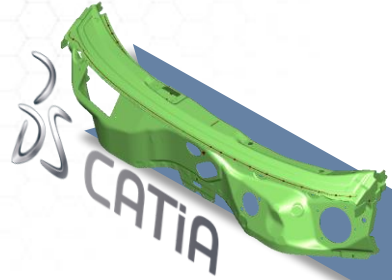


A high-angle, top-down view of a car body (chassis) positioned on a conveyor belt in a modern manufacturing facility. The car body is light blue and is being worked on by several robotic welding arms. The arms are orange and black, with yellow and green lights indicating active welding or sensor operation. The background shows the complex machinery of the factory, including various pipes, cables, and structural elements. The floor is made of metal grating. The overall scene is brightly lit with industrial lighting.

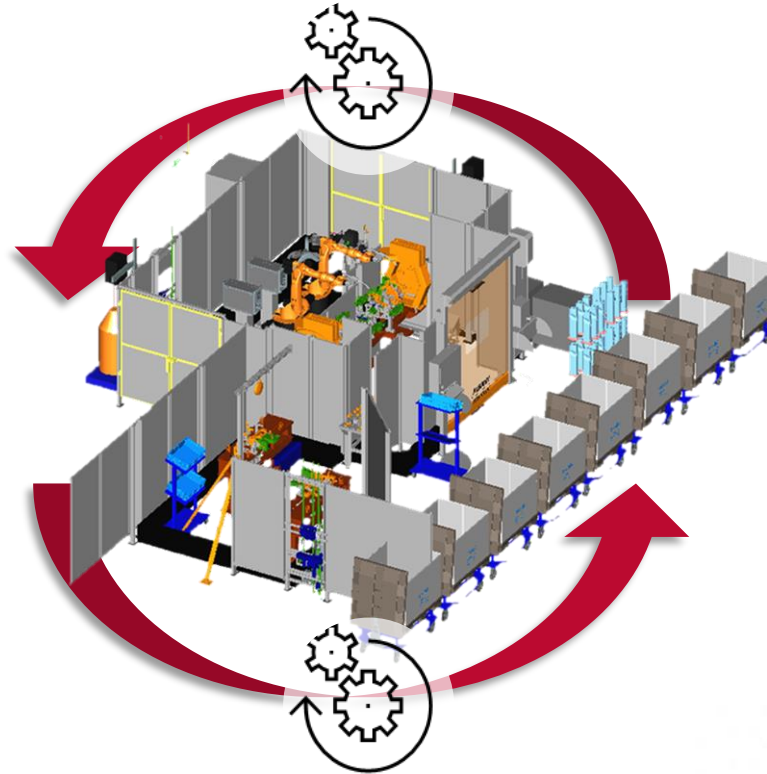
The smart arc in modern car body  
manufacture...



## The smart arc



Nr.	Material	t
XX_1	HX260LA	1,2
XX_2	22MnB5	1,5
...	...	...



Perfect seam quality

## The smart arc

### „Automated Data Processing Systems“

Pre +



Pre



In



Post





# AGENDA

- 
- 
- 
- 
- 
- 

» **Summary**



## Summary



- › GMAW-Process has a wide range of applications
- › Further process advantages could be achieved without planning restrictions
- › Digital approaches at Audi shown a high potential
- › In future the GMAW-process will use all essential process informations
- › The smart arc operates autonomously and fully automatically

### **Smart arc in modern car body manufacture**



**... and the path of  
innovation continues ...**

