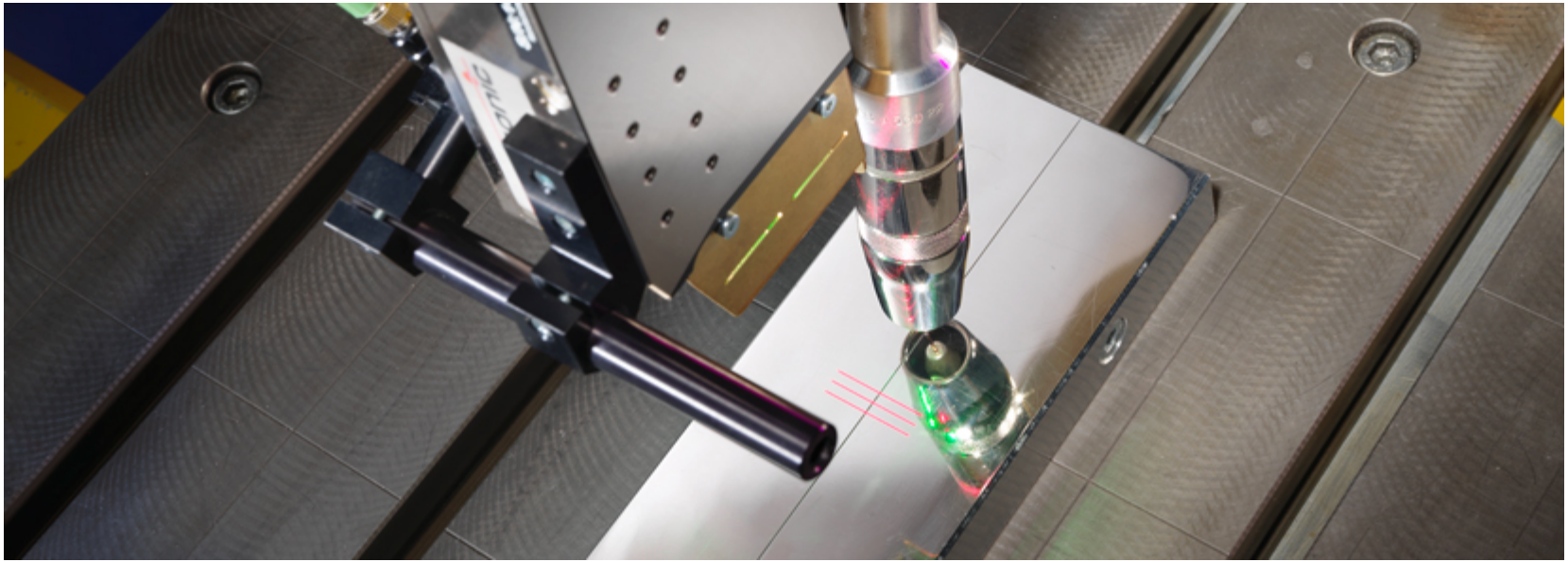


Optical Seam Tracking: Getting Started

Manual to Automation

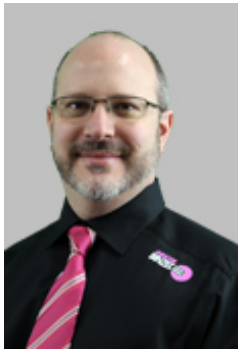
ABICOR BINZEL®

www.binzel-abicor.com

Optical Seam Tracking: Getting Started

Host and Panel Speaker

Matthew Sciannella
Director of Marketing
ABICOR BINZEL USA, Inc.



Scott Huber
Key Accounts Manager, Sensors & Robotics
ABICOR BINZEL USA, Inc.

Optical Seam Tracking: Getting Started

Agenda

- 6 Different ways to find a weld joint
- 4 Different ways to track a weld joint
- Technical overview Optical Seam tracking
    - Pro/Con analysis optical seam tracking
    - Application overview
        - Hard Automation
        - Robotic
- Overview
- Questions?

Optical Seam Tracking: Getting Started

Joint Finding Methods

6 Ways to Find a Weld Joint

- Manual Positioing of the Welding Wire into the Joint
- Using wire for touch Sensing
- Using the Gas Nozzle for touch Sensing
- Using a One Dimension laser
- Using a Two Dimension laser
- 3D Laser Triangulation Seam Tracking

Optical Seam Tracking: Getting Started

Joint Finding Methods - Manual Positioning

What it is:

- Operator teaches or places weld wire at start of weld

How it Works:

- **Hard Automation**
  - ➢ Operator has to place weld wire into the joint
- **Robotics**
  - ➢ Programmer has to train the arc starts for proper location

Pros:

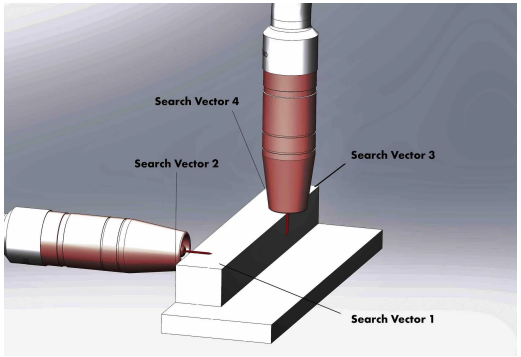
- Arc starts are on location each time
- Highly repeatable position with robotics

Cons:

- **Hard Automation**
  - ➢ Requires positioning every part
  - ➢ Operator-dependent for location
- **Robotics**
  - ➢ Won’t allow for joint mislocation
  - ➢ High tooling cost
  - ➢ Weld joint has to be consistent

Optical Seam Tracking: Getting Started

Joint Finding Methods – Wire Touch Sensing



What it is:

- Using the welding wire for joint detection

How it Works:

- Voltage applied to the welding wire
- When it comes in contact with a grounded part a signal is sent to the Robot and position is recorded.

Pros:

- No added hardware required
- Able to locate Arc Starts and Arc Ends

Cons:

- Slow and adds cycle time (3-5 seconds per search vector)
- Wire brake needed to maintain correct stickout
- Needs a clean surface for consistency and accurate part contact

Optical Seam Tracking: Getting Started

Joint Finding Methods – Nozzle Touch Sensing

What it is:

- Using gas nozzle for joint detection

How it Works:

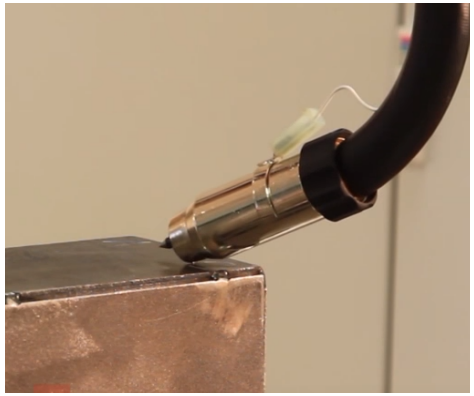
- Voltage applied to the gas nozzle
- When it comes in contact with a grounded part a signal is sent to the Robot and position is recorded.

Pros:

- No added hardware required
- Able to locate Arc Starts and Arc Ends

Cons:

- Slow and adds cycle time (3-5 seconds per search vector)
- Needs a clean surface for consistency and accurate part contact
- Nozzle needs to be free of spatter (added outer nozzle cleaner may be necessary)



Optical Seam Tracking: Getting Started

Joint Finding Methods – 1D Laser (One Dimensional)

What it is:

- Single laser beam

How it Works:

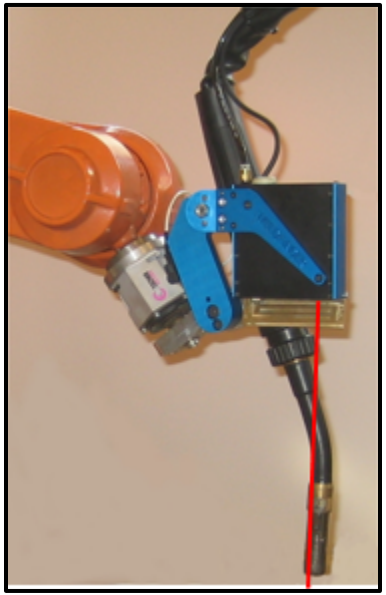
- One dimensional laser measures the distance of the part surface back to known position of the robot

Pros:

- Faster than touch sensing (1 second per search)
- Able to locate Arc Starts and Arc Ends

Cons:

- Needs a clear line of site to the part
- Adds hardware to the front of a robot arm and could limit weld access
- Higher maintenance



Optical Seam Tracking: Getting Started

Joint Finding Methods – 2D Laser (Two Dimensional)

What it is:

- Single laser beam

How it Works:

- Uses two dimension laser triangulation to find the joint in the “Y” and “Z” direction

Pros:

- Fast scan with only one position needed to get Arc start or Arc end locations (about .5 second per search)

Cons:

- Needs a clear line of site to the part
- Adds hardware to the front of a robot arm and could limit weld access
- Higher maintenance

Optical Seam Tracking: Getting Started

Joint Finding Methods – 3D Laser (Three Dimensional)

What it is:

- Laser lines to find the joint location

How it Works:

- Uses a three dimension laser triangulation to find the joint in the “Y” and “Z” direction.

Pros:

- Fast scan with only one position needed to get Arc start or Arc end locations (about .25 second per search)

Cons:

- Needs a clear line of site to the part
- Adds hardware to the front of a robot arm and could limit weld access
- Higher maintenance

Optical Seam Tracking: Getting Started

Comparison Chart for Finding

	Manual Positioning	Wire Touch Sense	Nozzle touch sense	1 D laser	2 D Laser	3D Laser Triangulation
	PROGRAMMING					
Skill Level Required	**1**	**3**	**3**	**2**	**2**	**4**
Need to Program Each Part	Yes					
Repeatability	No	Yes	Yes	Yes	Yes	Yes
Process Speed	Slow	Slow	Slow	Fast	Fast	Fast
Able to Locate Arc Starts/Ends	Yes	Yes	Yes	Yes	Yes	Yes
Requires Clear Line of Site to Part	No	No	No	Yes	Yes	Yes
Automatic Searching	No	Yes	Yes	Yes	Yes	Yes
	MATERIAL					
Ability To Handle Dirty Material	Yes	No	No	Hard	Hard	Yes
Weld Joint						
Butt	Yes	No	No	No	No	Yes
Lap	Yes	Yes	No	Yes	Yes	Yes
Filet	Yes	Yes	Yes	Yes	Yes	Yes
V-groove	Yes	Yes	No		Yes	Yes
	TOOLING					
Access To Weld Joint	Low	Low	Low	Medium	High	High
Tooling Cost	$	$	$	$$	$$$	$$$$
	OTHER					
Requires Additional Hardware	No	Software Option	Software Option	Yes	Yes	Yes
Maintenance Level Required	None	Low	Low	Medium	Medium	Medium

Optical Seam Tracking: Getting Started

4 Ways to Track a Joint

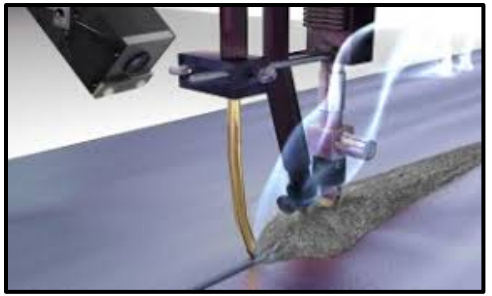
Joint Tracking Methods

- Laser Pointer and Manual Slides
- Tactile Probes with Automated Slides
- TAST (Through the Arc Seam Tracking)
- 3D Laser Triangulation Seam Tracking (Hard Automation & Robotics)

Optical Seam Tracking: Getting Started

Fixed Point and Manual Slides

Joint Tracking Methods



What it is:

- Uses a fixed pointer in-line with the Weld Wire

How it Works:

- Operator manually controls the position of the welding wire by visually following the weld joint with the pointer

Pros:

- Low cost
- Easy to maintain operation

Cons:

- Relies on an operator to have full focus throughout the weld cycle
- Probe could become bent causing miss located weld
- Weld position is subjective to the operators viewing position

Optical Seam Tracking: Getting Started

Joint Tracking Methods-

Tactile Probe with Automated Slides

What it is:

- Uses a probe that contacts the part and rides in the weld joint.

How it Works:

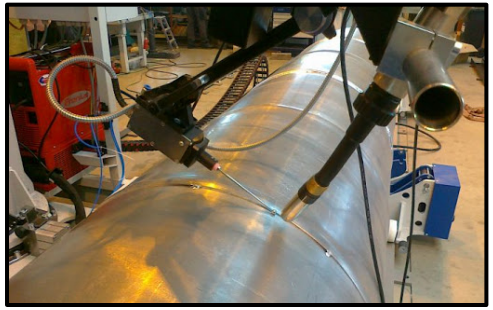
- Operator manually places the probe in the weld joint
- As the weld head moves along the joint the probe is relaying movement back to a set of cross slides.

Pros:

- Minimum operator interface to track
- Low cost for semiautomatic weld process

Cons:

- Probe could become bent causing miss located weld.
- Probe requires to have contact with part
- Probe has difficulties avoiding tack welds or a joint with limited features



Optical Seam Tracking: Getting Started

TAST (Through the Arc Seam Tracking)

Joint Tracking Methods

What it is:

- Using current feedback to track the joint

How it Works:

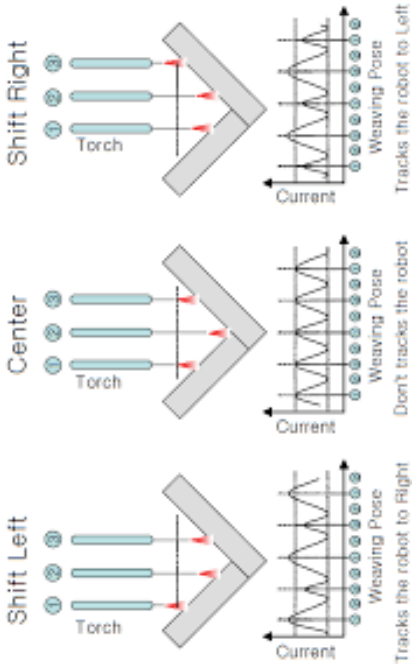
- The electrical stick-out changes during weaving causing a change in current.
- This change is monitored and allow the robot to track the joint

Pros:

- No added hardware required
- Not effected by torch angles
- Works on V-grove, Fillet, and Lap joints that may be tough to program robot path

Cons:

- Must have weave to function
- ¼” minimum material thickness for Lap joints for TAST
- Must have clean weld surface as TAST relies on current feedback to track
- Can’t use with Aluminum



ABICOR BINZEL®

www.binzel-abicor.com

Optical Seam Tracking: Getting Started

3D Laser Triangulation Seam Tracking With Hard Automation

Joint Tracking Methods

What it is:

- Non-contact laser seam tracking

How it Works:

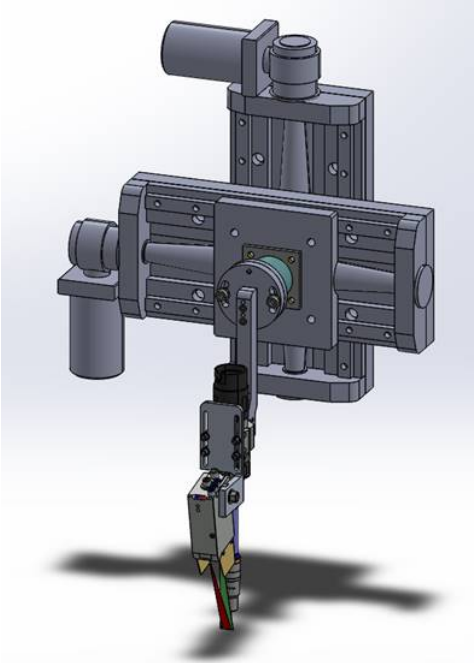
- Set of laser emit from the sensor and reflect back onto a board
- Sensor locates joint position via Triangulation and relays data back to the Controller

Pros:

- Easy interface to Control System
- Works on TIG, MIG, & Sub-Arc
- Simple, straightforward programming
- Low maintenance

Cons:

- Difficulty accessing hard to reach joints
- Limited clearance
- Cost intensive



ABICOR BINZEL®

www.binzel-abicor.com

Optical Seam Tracking: Getting Started

3D Laser Triangulation Seam Tracking With Robotics

Joint Tracking Methods

What it is:

- Non-contact laser seam tracking

How it Works:

- A set of laser beams are emitted from the sensor and reflected back onto a board
- Through triangulation the sensor is able to locate the joint position and relay that data back to the robot

Pros:

- Real time tracking decreases cycle times
- Tracks reflective surfaces and over weld tacks
- Adaptive to joint irregularities
- Fairly simple, straightforward programming
- Low maintenance

Cons:

- Difficulty accessing hard to reach joints
- Limited clearance
- Cost intensive
- Hit and miss with Robot OEM Interfacing

Optical Seam Tracking: Getting Started

Optical

What You Get and What You Don‘t

Seam Tracking Gains:

- Improved weld quality
- Decreased weld cycle time
- Reduce part scrap and rework
- Reduced labor cost / deployment
- Increased travel speed

Seam Tracking Will Not:

- Solve poor tooling or fixturing
- Account for poor weld joint fit-up
- Fix incorrect or offset weld parameters
- Improve your access to the joint
- All of your quality problems

ABICOR BINZEL®

www.binzel-abicor.com

Optical Seam Tracking: Getting Started

Optical

Who Can Seam Tracking Help?

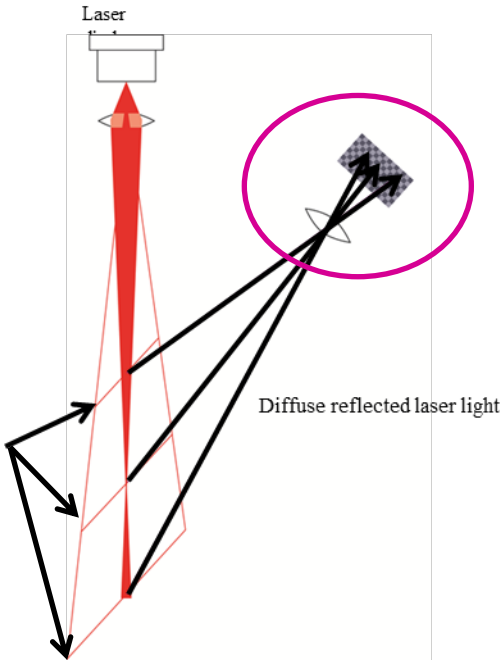
- Automated welding systems (automatic or semi)
- High manual input to set up / maintain welding process
- Variance in part position from setup to setup (related to single parts of tooling)
- High scrap rates
- Poor first pass quality

Optical Seam Tracking: Getting Started

3D Seam Tracking

How Does Optical Work?

- Optical seam tracking technology based on laser measuring technics. Generates 3 beams oriented to object that‘s to be measured
- When 3 beams come in contact with the object, it reflects light to a CMOS sensor housed in the camera
- Information recorded by CMOS sensor as a set of bright points of light. Individual pixels are filtered and summarized by the electronics which are placed in the CMOS sensor
- Results in row data sets representing real 3D contour of the measured part



Optical Seam Tracking: Getting Started

3D Seam Tracking

Questions to Consider Before Implementation

- What‘s my joint profile?
- What‘s my current challenge?
- What are my goal in solving for this challenge? ***i.e., First time weld quality***
- Can my challenge be solved or goal met programmatically before adding more technology?
- What‘s my clearance, stand-off, and mounting needs?
- What‘s my current in-house talent level?
- What‘s my budget?
- What‘s my timeline for implementation, realized ROI, etc.?
- What is cost of upkeep?
- What does maintenance look like?

Optical Seam Tracking: Getting Started

3D Seam Tracking

How is Optical Seam Tracking More User-friendly?

- Pre-scanned joint profile
- Easy to understand User Interface
- Technology hardware isolated from the arc
- Zero gap capability
- Suitable for many materials frequently welded with various finishes (flat, reflective, etc.)
- Usable in non-welding applications (gluing, cutting, etc.)

Optical Seam Tracking: Getting Started

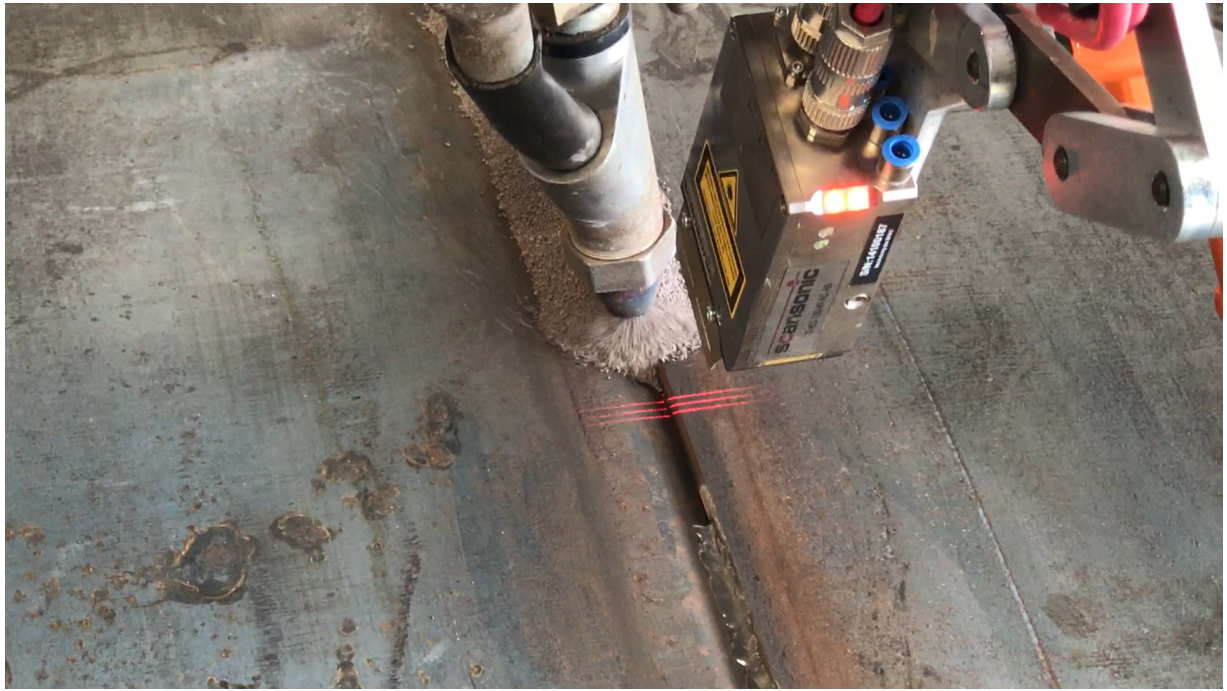
Compairison Chart for Seam Tracking

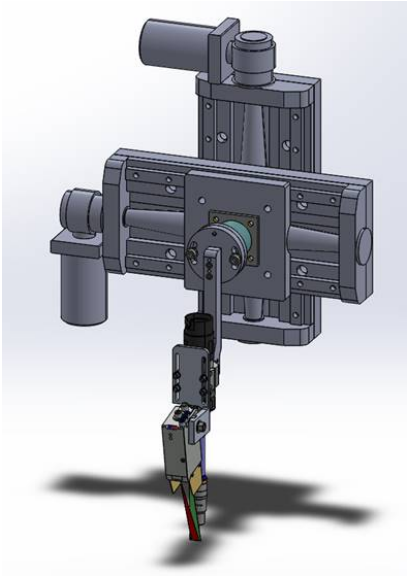
	Manual	Semi-auto	Automated	
	Laser Pointer/Manual Slides	Tactile Probe/Auto Slides	Through The Arc Seam Tracking (TAST)	3D Laser Triangulation
	PROGRAMMING/PROCESS			
Skill Level Required	1	2	3	4
Need to Program Each Part	Yes	No	No	No
Manual Positioning	Yes	Yes	No	No
Repeatability	1	2	4	5
Process Speed	Slow	Slow	Medium	High
Requires Clear Line of Site to Part	No	Yes	No	Yes
Automatic Adjustments	No	Yes	Yes	Yes
Weave Required	No	No	Yes	No
Affected By Torch Angle	0	3	0	4
Reduces Cycle Time	0	2	4	5
Handles Part Variation Well	0	3	4	4
Reliable/Repeatible Process	0	2	4	5
	MATERIAL			
Ability To Handle Dirty Material	Yes	No	No	Yes
Weld Joint				
Butt	Yes	No	No	Yes
Lap	Yes	No	Yes	Yes
Filet	Yes	Yes	Yes	Yes
V-groove	Yes	Yes	Yes	Yes
Minimum Material Thickness Required	No	Yes	Yes	No
	TOOLING			
Access To Weld Joint	Low	High	Medium	High
Tooling Cost	$	$$	$$	$$$$
	OTHER			
Requires Additional Hardware	No	Yes	No	Yes
Maintenance Level Required	None	Low	Low	High

Optical Seam Tracking: Getting Started

Joint Tracking Methods

3D Laser Triagulation Seam Tracking With Hard Automation

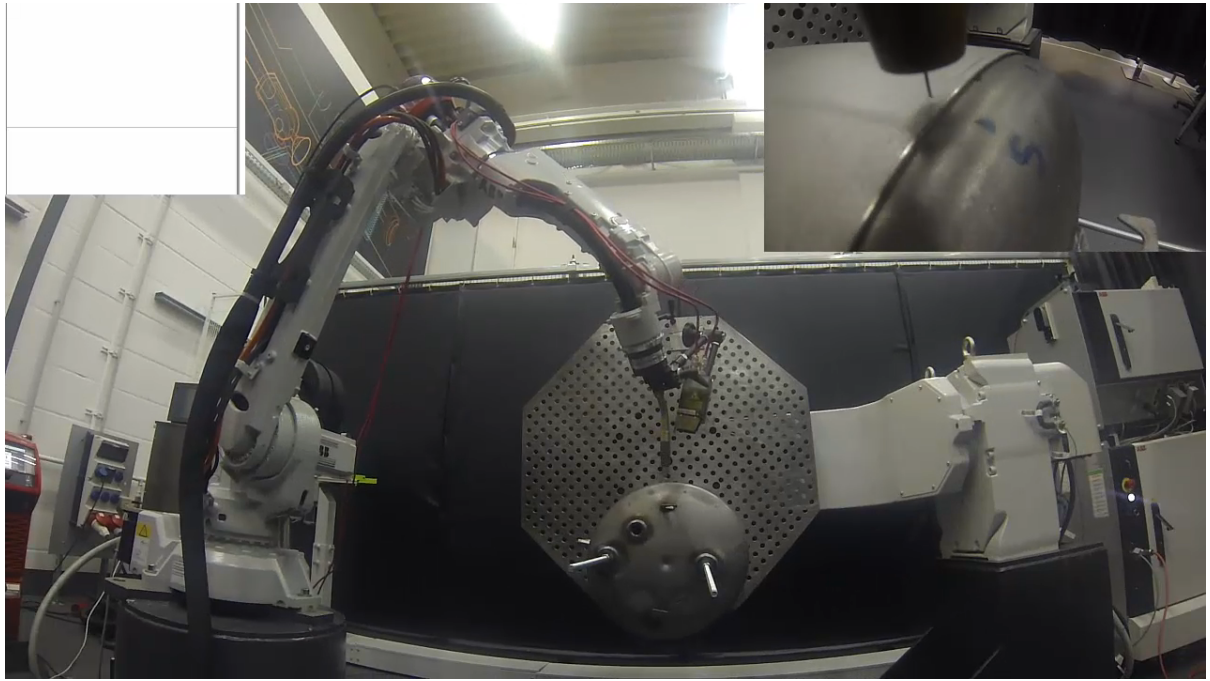




Optical Seam Tracking: Getting Started

Joint Tracking Methods

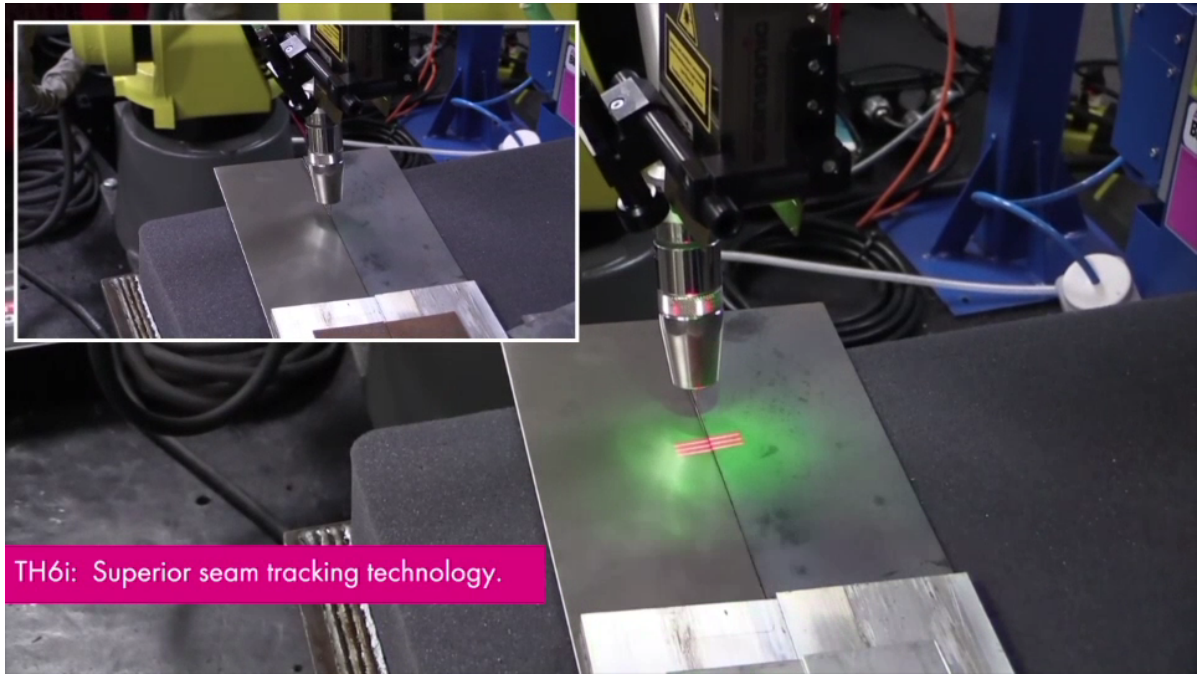
3D Laser Triagulation Seam Tracking With Robotics (XYZ Measurement)



Optical Seam Tracking: Getting Started

Joint Tracking Methods

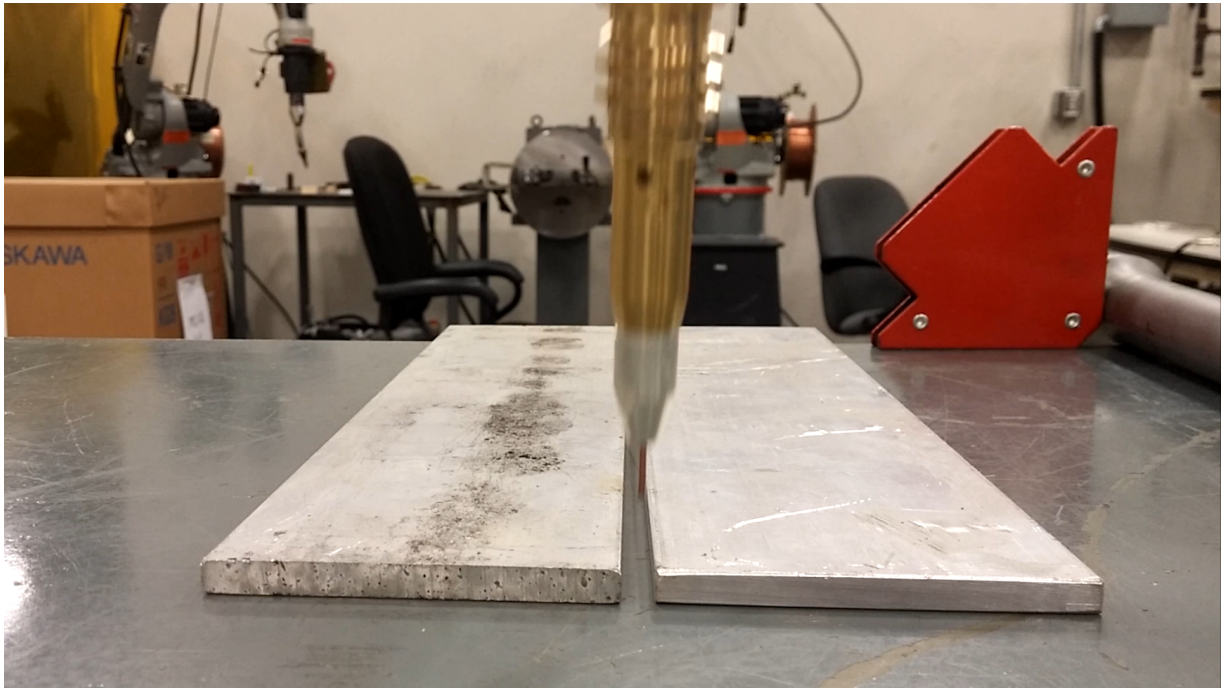
3D Laser Triagulation Seam Tracking With Robotics (Zero Gap Measurement)



Optical Seam Tracking: Getting Started

Joint Tracking Methods

3D Laser Triagulation Seam Tracking With Robotics (Difficult to Track Material)

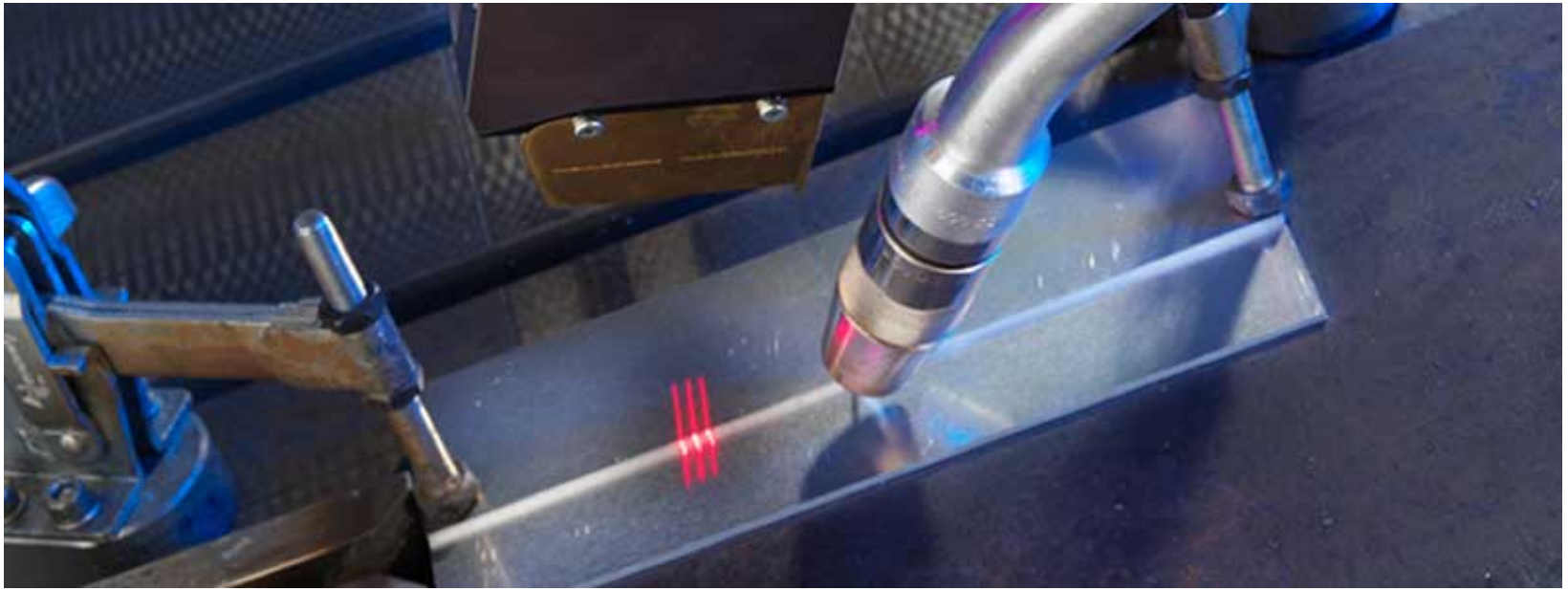


Optical Seam Tracking: Getting Started

Overview

Find what best fits your application…

- Finding / Tracking
  - ✓ Can be done so via mechanical or optical means, manually or automatically driven.
- Find the best technology to fit your applications needs based on
  - ✓ Manpower allocation allotted
  - ✓ Complexity of part being processed
  - ✓ Project budget
  - ✓ Automation selected (Boom /Gantry, Robotic, etc.)Robotic
  - ✓ Process requirements (MIG, TIG, Sub-arc, etc.)



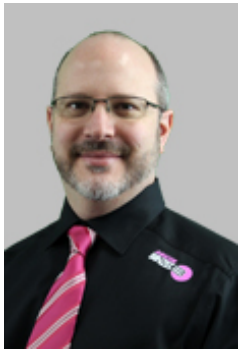
QUESTIONS?

Weld Joint Seam Tracking

ABICOR BINZEL®

www.binzel-abicor.com

Contact Us!

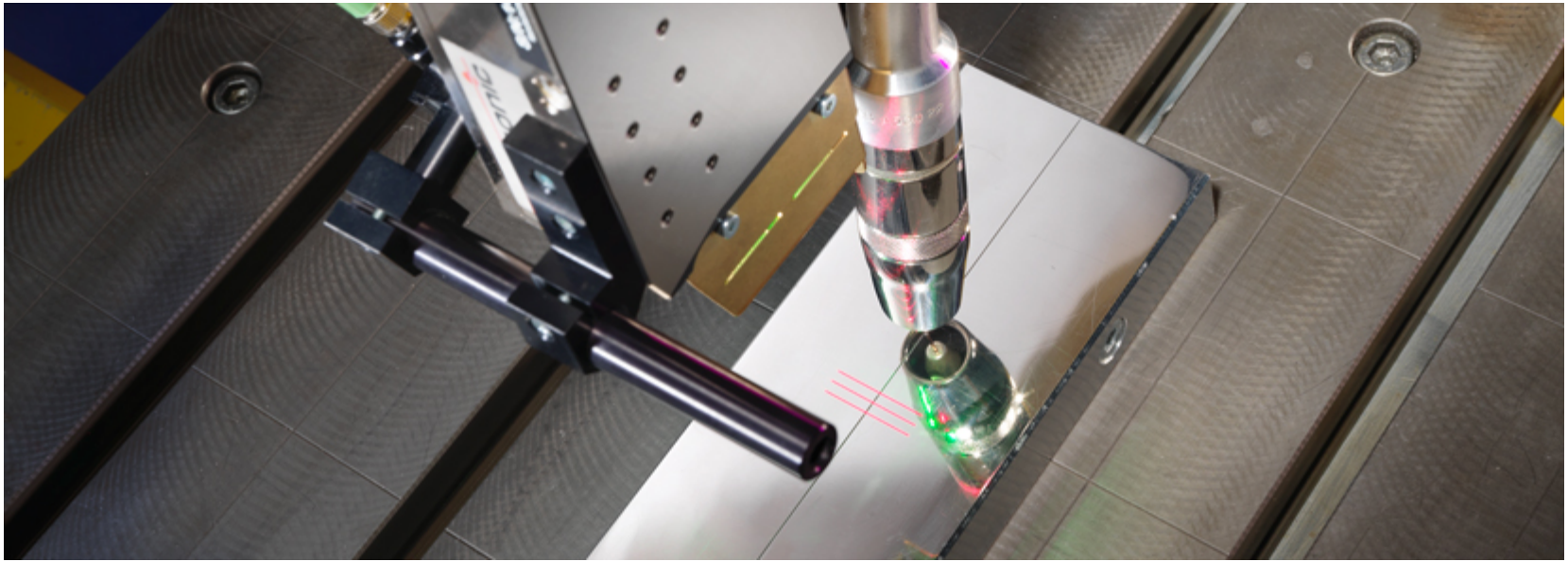


Scott Huber
Key Accounts Manager, Sensors & Robotics
ABICOR BINZEL USA, Inc.

Phone: 865-368-1093
Email: shuber@abicorusa.com

ABICOR BINZEL District Sales Team
United States & Canada

https://www.binzel-abicor.com/US/eng/contact/usa-contacts/



Thank You!

For Attending

ABICOR BINZEL®

www.binzel-abicor.com