

Robotic Automation and Lean Manufacturing Applied to Laser Marking

August 1, 2024



SPONSORS

FOBA[®]
Laser at your service

 **UNIVERSAL
ROBOTS**

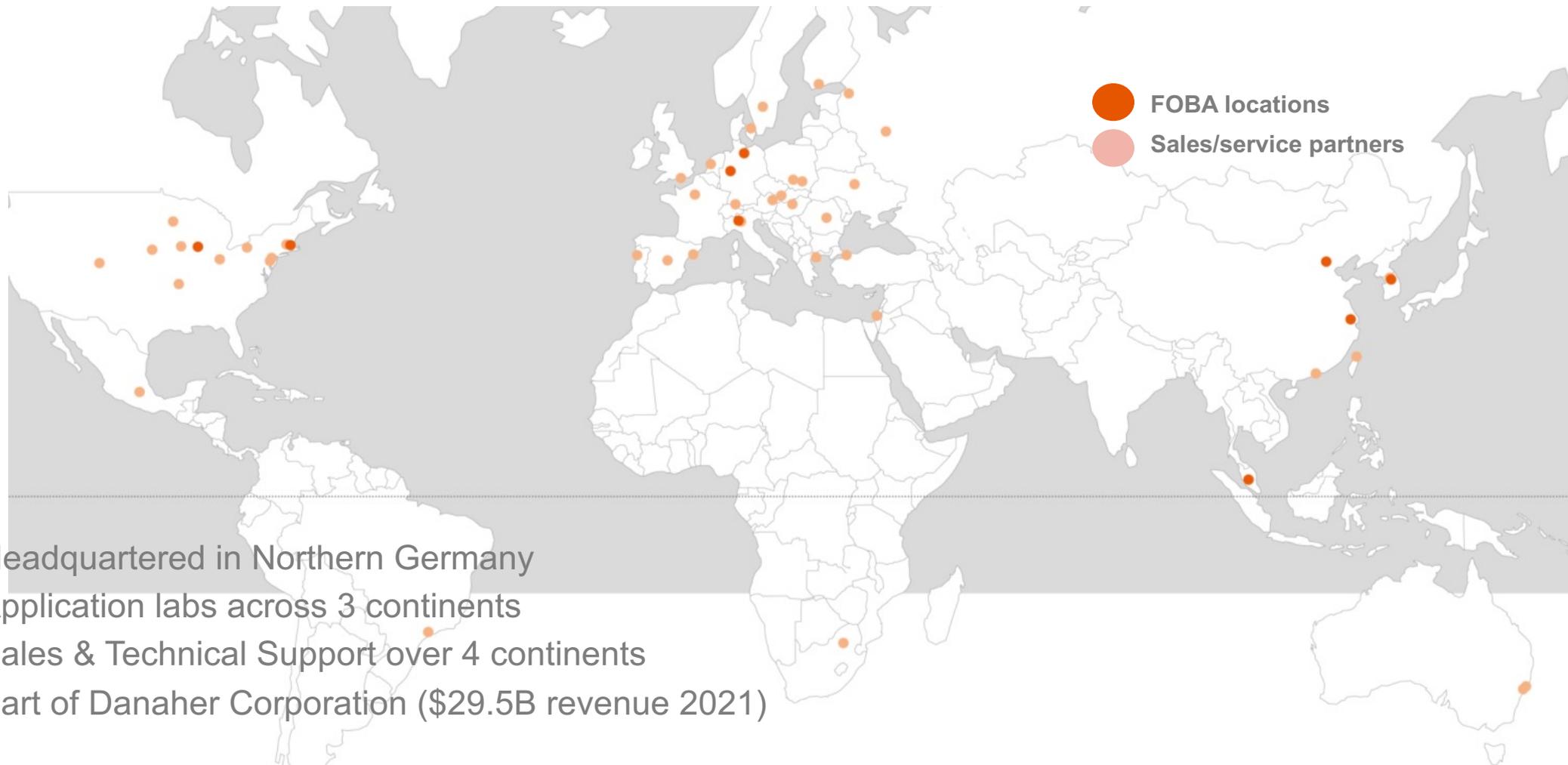
Flexxbotics[™]

Your Speaker

- **Dr. Faycal Benayad-Cherif**
- Medical Global Strategic Account Manager at FOBA Laser Marking + Engraving, a Danaher Company
- More than 25 years of experience in the innovation, development and management of laser-based products
- Developed laser-based imaging solutions and vision technologies that offer highly innovative ways to improve production and traceability processes using laser technology



FOBA Worldwide: A Global Organization



- Headquartered in Northern Germany
- Application labs across 3 continents
- Sales & Technical Support over 4 continents
- Part of Danaher Corporation (\$29.5B revenue 2021)

ALLTEC (FOBA) Laser Business Unit (LBU)

Part of Veralto Corp.

- ~16,000 employees
- Turnover 2023: US\$ 5bn
- A total of 13 companies

Employees at ALLTEC

- > 250 weltweit

Application Lab / Spare Parts

- Selmsdorf, GER
- Wood Dale, IL, USA
- Shanghai, China

Manufacturing

- Capacity: + 2.000 systems/year
- Production sites in Germany, USA and China



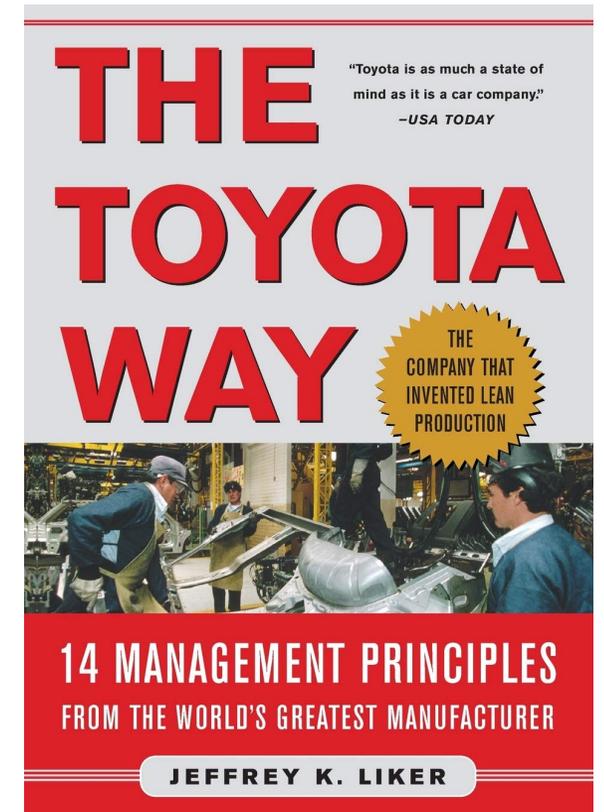
Why do people look at lean manufacturing?

TO ELIMINATE WASTE!

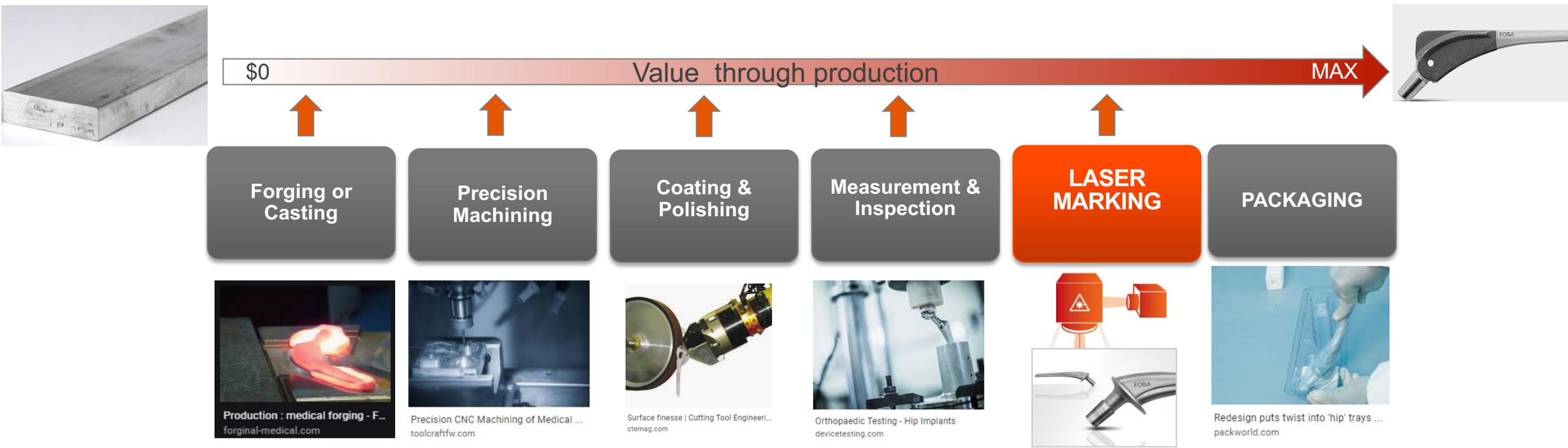
Lean Production

LEAN: work on eliminating waste from the manufacturing process

WASTE: activity that does not add value to the customer



In most laser marking applications...



... is the last step before packaging

Key Elements of Lean Manufacturing

Reducing waste

Waste comes in different forms:

1. Defects
2. Waiting
3. Transportation
4. Motion
5. Extra processing
6. Inventory Waiting
7. Overproduction
8. Non-utilized talent



waywedo.com



Beer-simple.com



Investopedia.com



Case 1: Rocker arm for a compression release engine brake

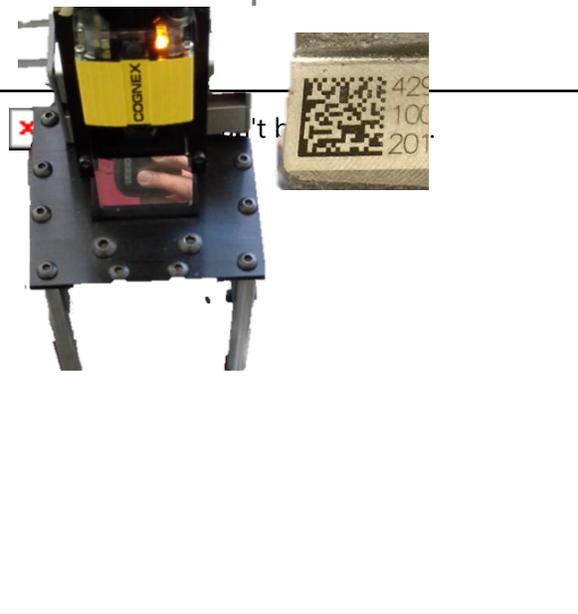


Jake Brake, is an engine braking mechanism installed on some diesel engines to slow down trucks going down hill.

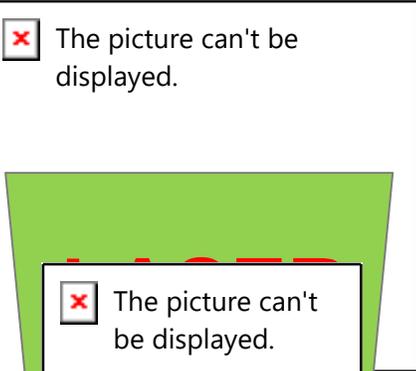
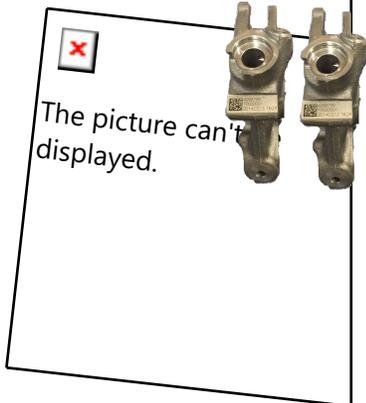
Automotive Example: Braking component

Shared station

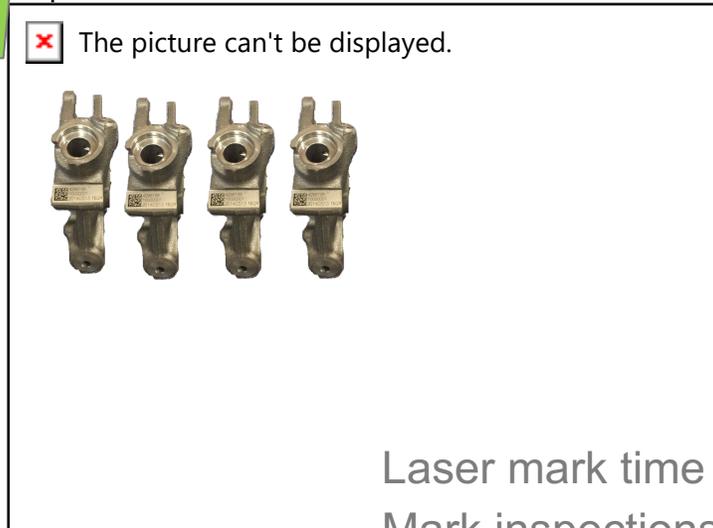
2D code Inspection 20sec



Outgoing parts



Laser Marking 12 sec

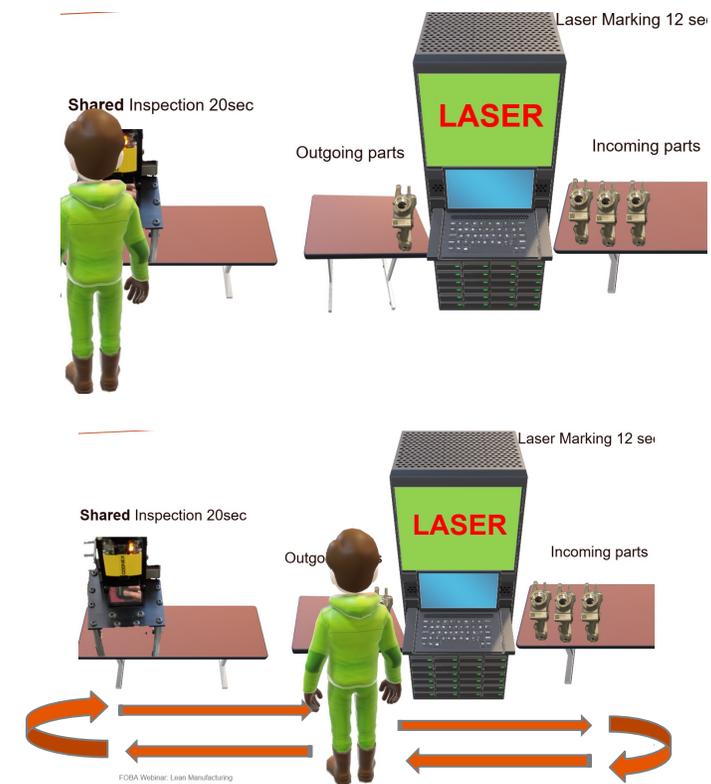


Laser mark time 12 Sec w. load/unload
Mark inspections station: 20 sec
Travel time between stations: 15 sec

TOTAL 47 sec

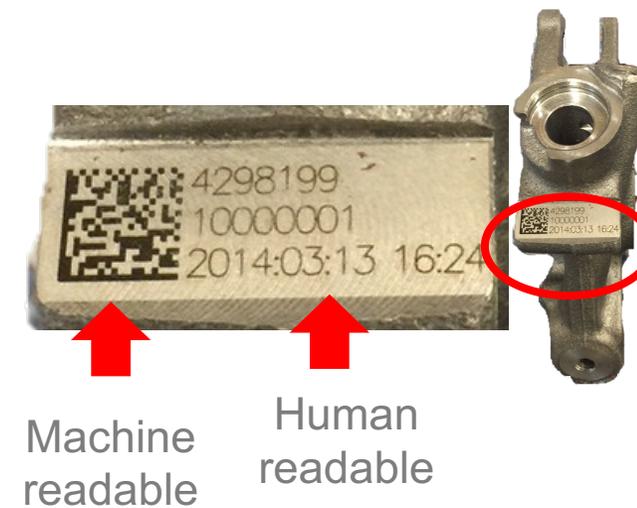
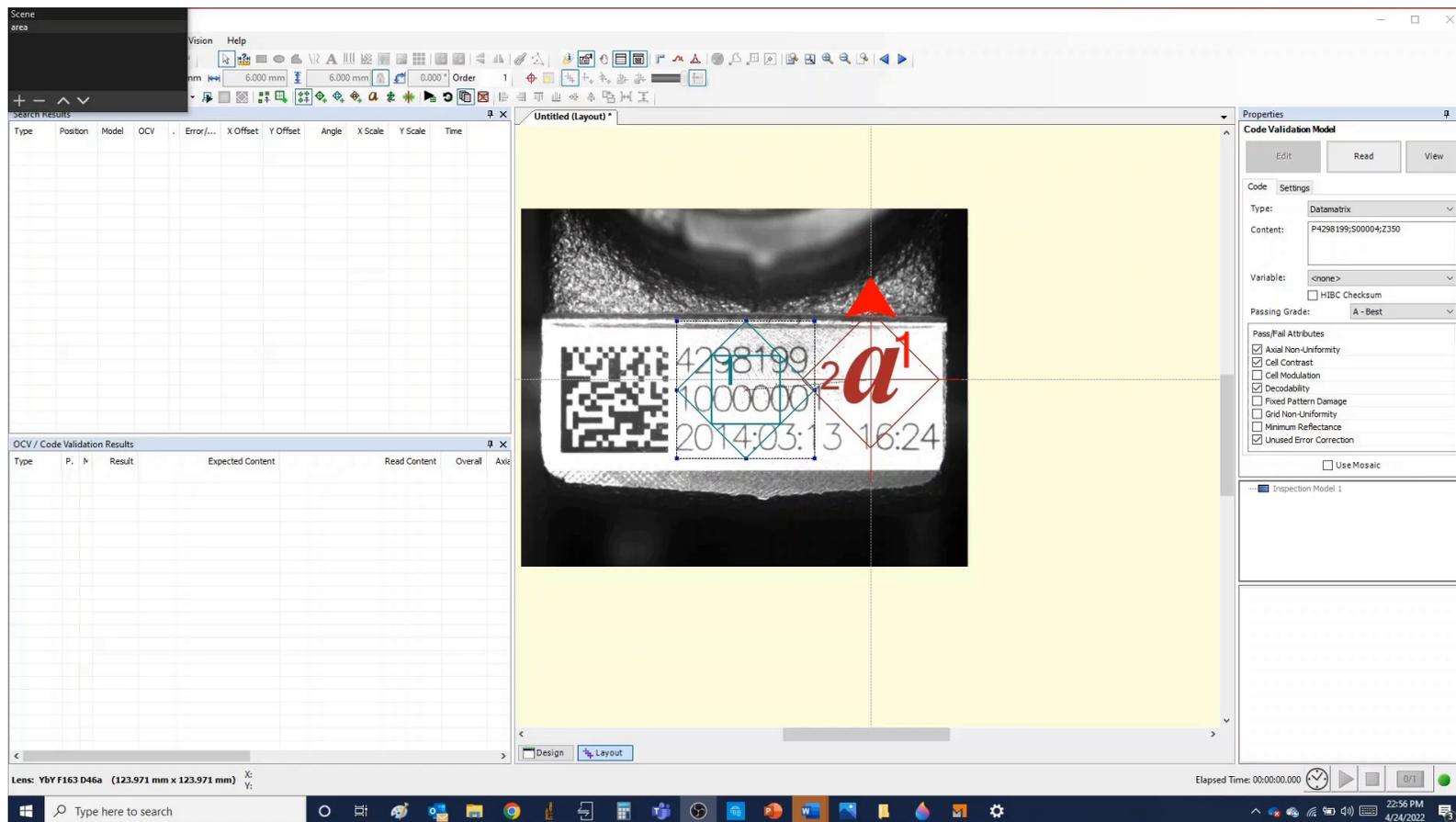
3 Lean challenges:

1. **Waiting time** at code validation station 20 sec (50% of process)
 1. **Inspection time** 20 sec
 2. **Shared station**
2. **Motion travel** to different stations 15 sec
3. **Extra processing** : Handling part to the Inspection
4. ~~Defects~~
5. ~~Transportation~~
6. ~~Inventory Waiting~~
7. ~~Overproduction~~
8. ~~Non-utilized talent~~



- Fully integrate code validation in the laser software
- Eliminate unnecessary motion

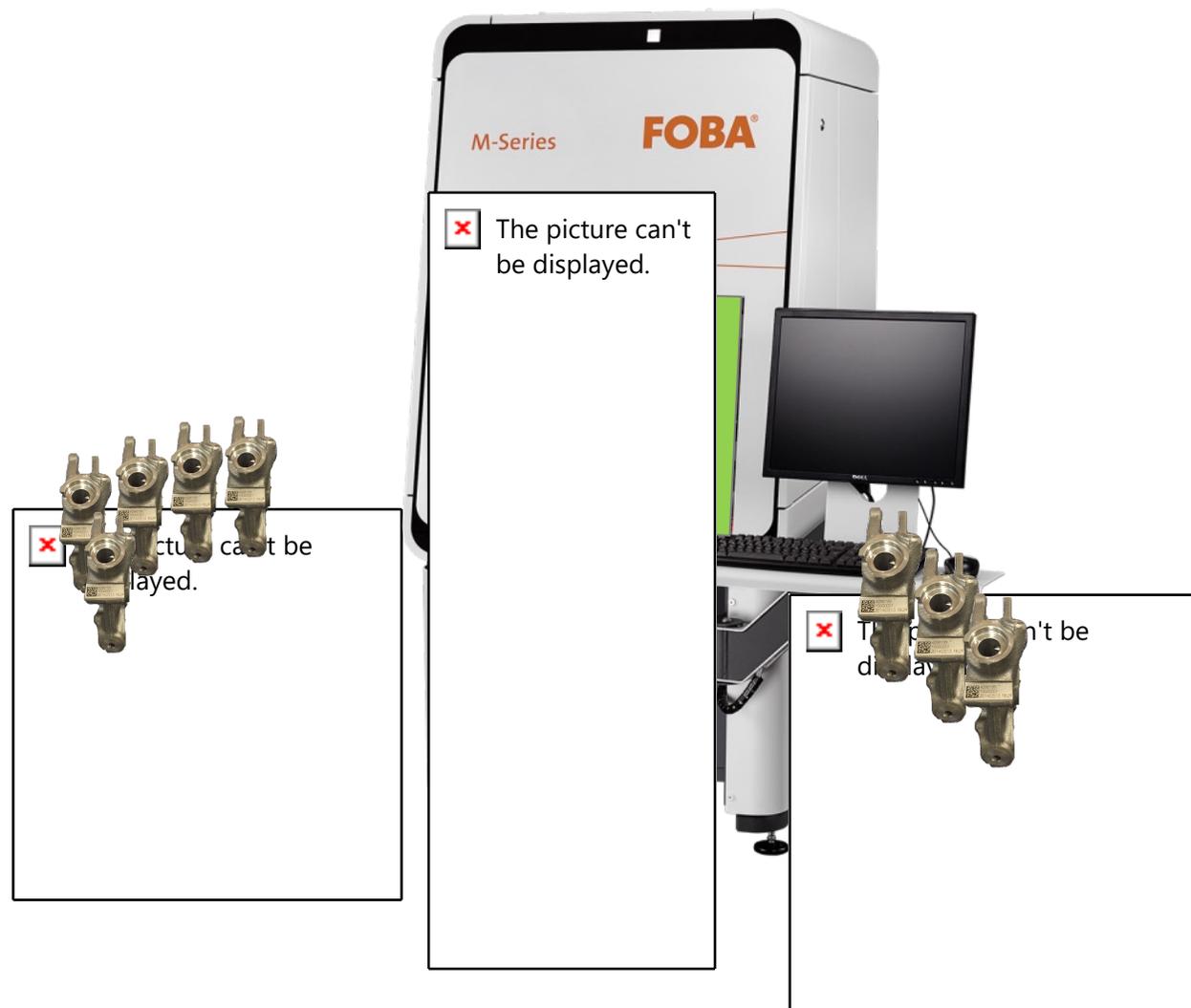
Solution: Fully Integrate Code validation in the laser



Code validation time reduced from 20 sec to 0.5sec

Outcome Leaner process

- ~~1. Waiting time~~
- ~~2. Motion travel to different station~~
- ~~3. Extra processing~~
- ~~4. Defects~~
- ~~5. Transportation~~
- ~~6. Inventory Waiting~~
- ~~7. Overproduction~~
- ~~8. Non-utilized talent~~



System in the factory

- Laser mark time 12 sec (incl. Load.unload)
- Mark inspections station: **20 sec**
- Travel time between stations: **15 sec**
- **TOTAL 47 sec** per part

- Laser mark time 12 sec (incl. Load.unload)
- Mark inspections station: **0.5 sec**
- Travel time between stations: **0 sec**
- **TOTAL 12.5 sec** per part



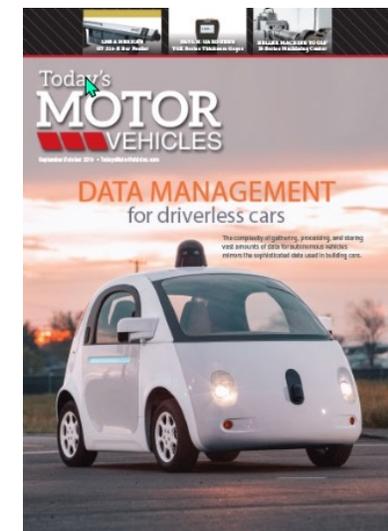
Brent Mayerson Manuf.Eng.



Brake in the laser

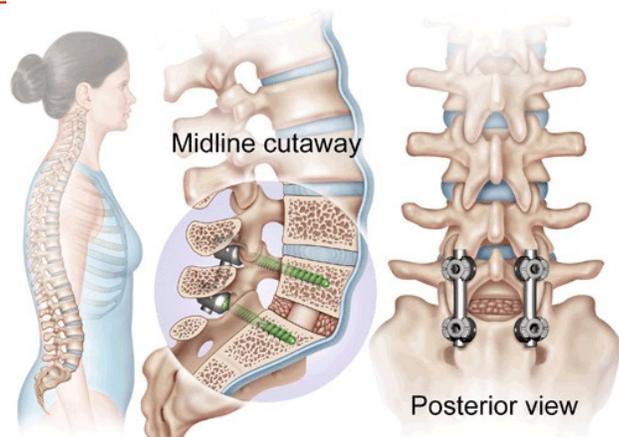


Assembled brake

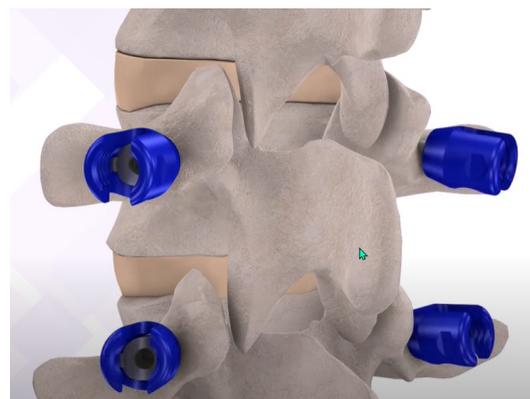


<https://www.todaysemobility.com/article/tmv0915-foba-laser-marking-traceability/>

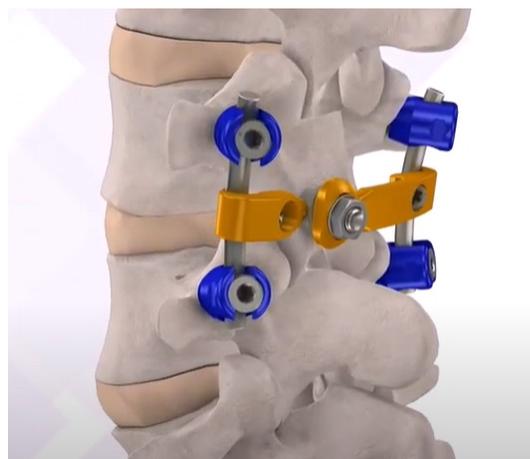
Medical Case: Medical Implant Marking



Bone Spine Surgery.
<https://www.waynecheng.com/>



Pedicle screws in each vertebra



Interspinous Process Compressor & Pedicle screw

VTI: InterLink™ Pedicle Screw Surgical Technique
<https://www.youtube.com/watch?v=i08VY5H6T8w>

Medical devices need to be laser marked for traceability purposes according to FDA regulation:

Unique Device Identifier (UDI)

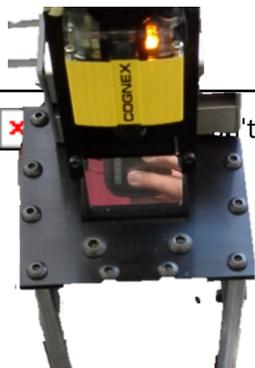
Machine readable →
Human readable →



Case 2 : Pedicle screw marking process (10 per tray)

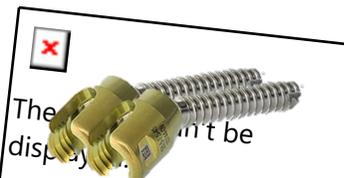
2D code
Inspection
60 sec

Microscope
text inspection
60sec



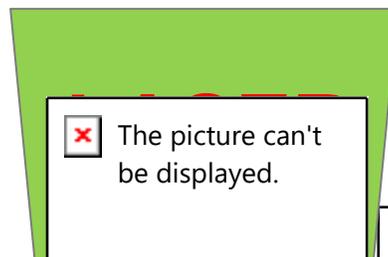
x The picture can't be displayed.

Outgoing parts



x The picture can't be displayed.

x The picture can't be displayed.



x The picture can't be displayed.

Laser Marking 50 sec

x The picture can't be displayed.



Laser mark time 50 Sec

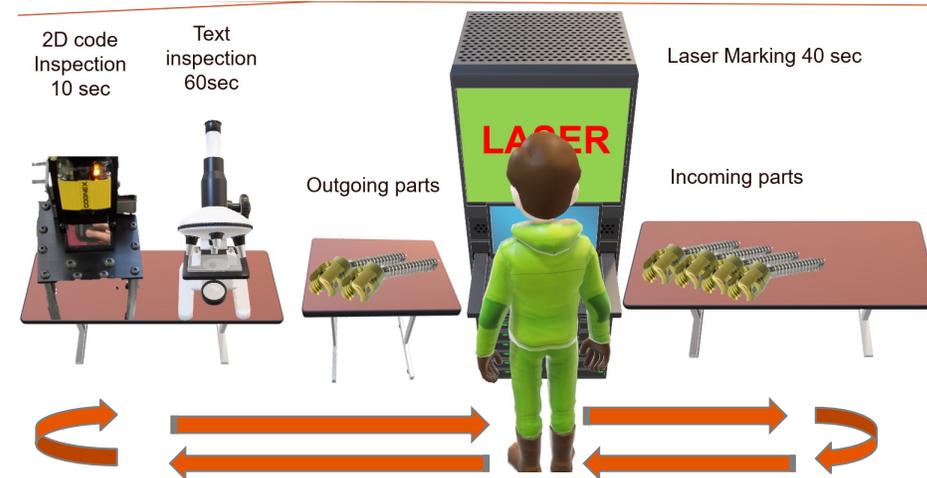
Mark inspections stations: 120 sec

Travel time between stations: 15 sec

TOTAL 185 sec – 3 min

4 Lean challenges:

1. **Waiting** time spent at both inspection stations
 1. **Inspection time 2 min**
 2. **Shared stations (microscope)**
2. **Motion** travel to different stations 15 sec
3. **Extra processing** : Handling part to the Inspection
4. **Defects**
5. ~~Transportation~~
6. ~~Inventory~~ ~~Waiting~~
7. ~~Overproduction~~
8. ~~Non-utilized talent~~



OK



Waste

Solution: Eliminate human visual inspection

The screenshot shows the MarkUS! Designer software interface. The main window displays a camera view of a metal part with a QR code and the text "PS5.5-7.5-45 10744-09". A red arrow points to the QR code, and another red arrow points to the text. The software interface includes a menu bar, a toolbar, and a properties panel on the right. The properties panel is titled "Code Validation Model" and contains the following settings:

- Type: Datamatrix
- Content: ~1010081235202042710110744-09
- Variable: <none>
- Passing Grade: C - Fair
- Pass/Fail Attributes:
 - Axial Non-Uniformity
 - Cell Contrast
 - Cell Modulation
 - Decodability
 - Fixed Pattern Damage
 - Grid Non-Uniformity
 - Minimum Reflectance
 - Unused Error Correction
- Use Mosaic

At the bottom of the software window, there is a table titled "OCV / Code Validation Results":

Type	P.	R.	Result	Expected Content	Read Content	Over
Datamatrix	1	1	PASS	[GS1] ~1010081235202042710110744-09	[GS1] ~1010081235202042710110744-09	
Datamatrix	1	1	PASS	[GS1] ~1010081235202042710110744-09	[GS1] ~1010081235202042710110744-09	
Datamatrix	1	1	FAIL	[GS1] ~1010081235202042710110744-09	[GS1] ~101008123520204271011	



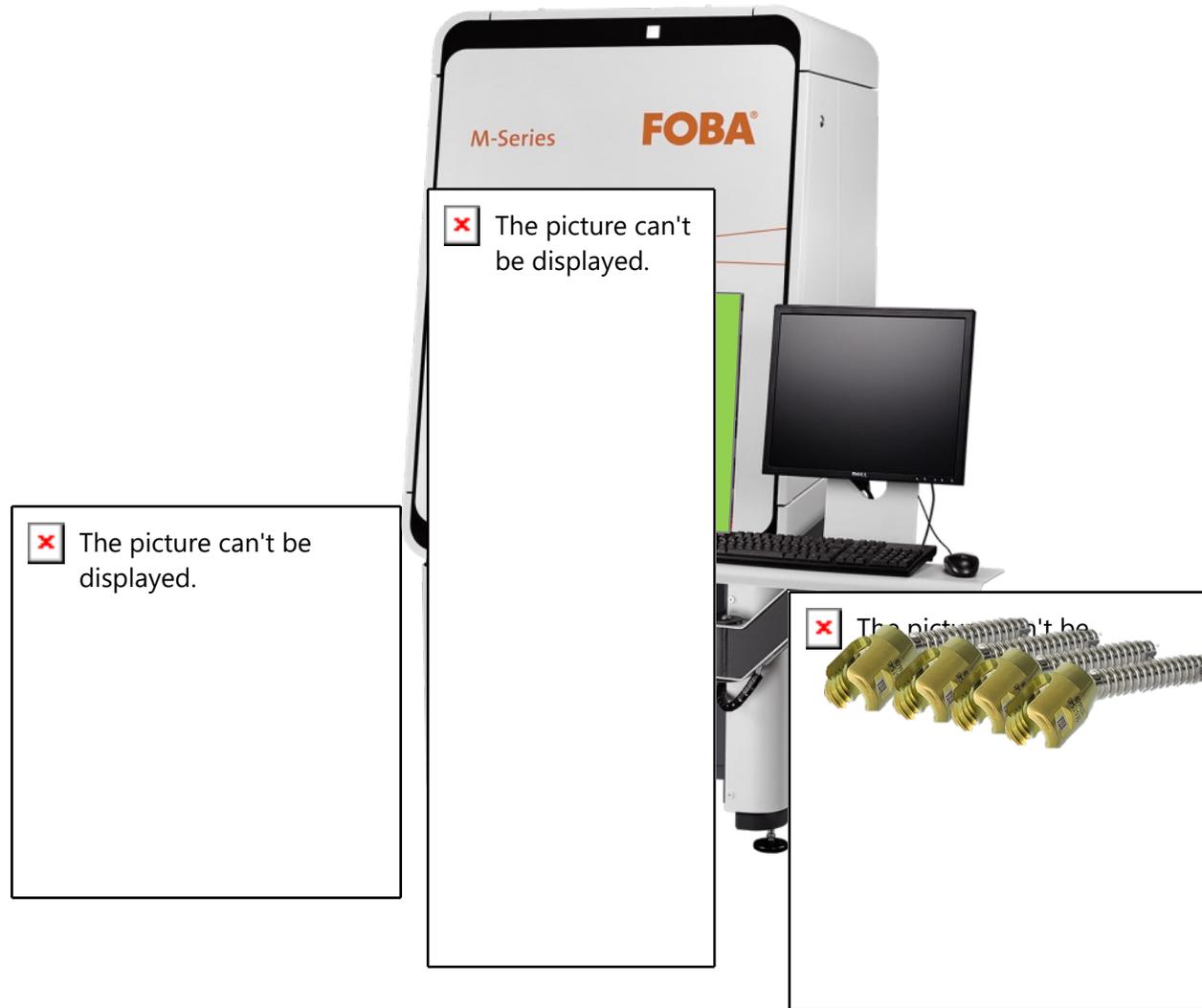
Machine readable

Human readable



Total code validation & optical character inspection reduced from 120 sec to 10 sec

- Eliminated
 - Unnecessary motion
 - Defective marks (laser auto-correction)
 - Manual inspection using:
 - OCV (optical character verification)
 - Code validation
- Reduced:
 - Part handling time
 - Occupied Space



Case 3: Lean manufacturing using COBOTs

Manually loaded **fixture-based** system



Robotic **Unattended Operation**



Benefits of COBOT based systems

- Can operate over multiple shifts without human intervention
- Ideal for large volumes
- Low cost of operation
- Quick Return On Investment
- Easy to program
- Safe to operate

Conclusion

Lean manufacturing:

- Improves quality
- Increases efficiency
- Adds value to the customer
- Allows better use of floor space
- Brings financial benefits
- Encourages innovation and challenges
- Incentivizes employee engagement
- Helps the environment

Laser Marking +
Engraving Solutions



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Let's hear your questions...

Free to contact us at any time:

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