

# Robotic Automation and Lean Manufacturing Applied to Laser Marking

August 1, 2024



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*Laser at your service*

 **UNIVERSAL  
ROBOTS**

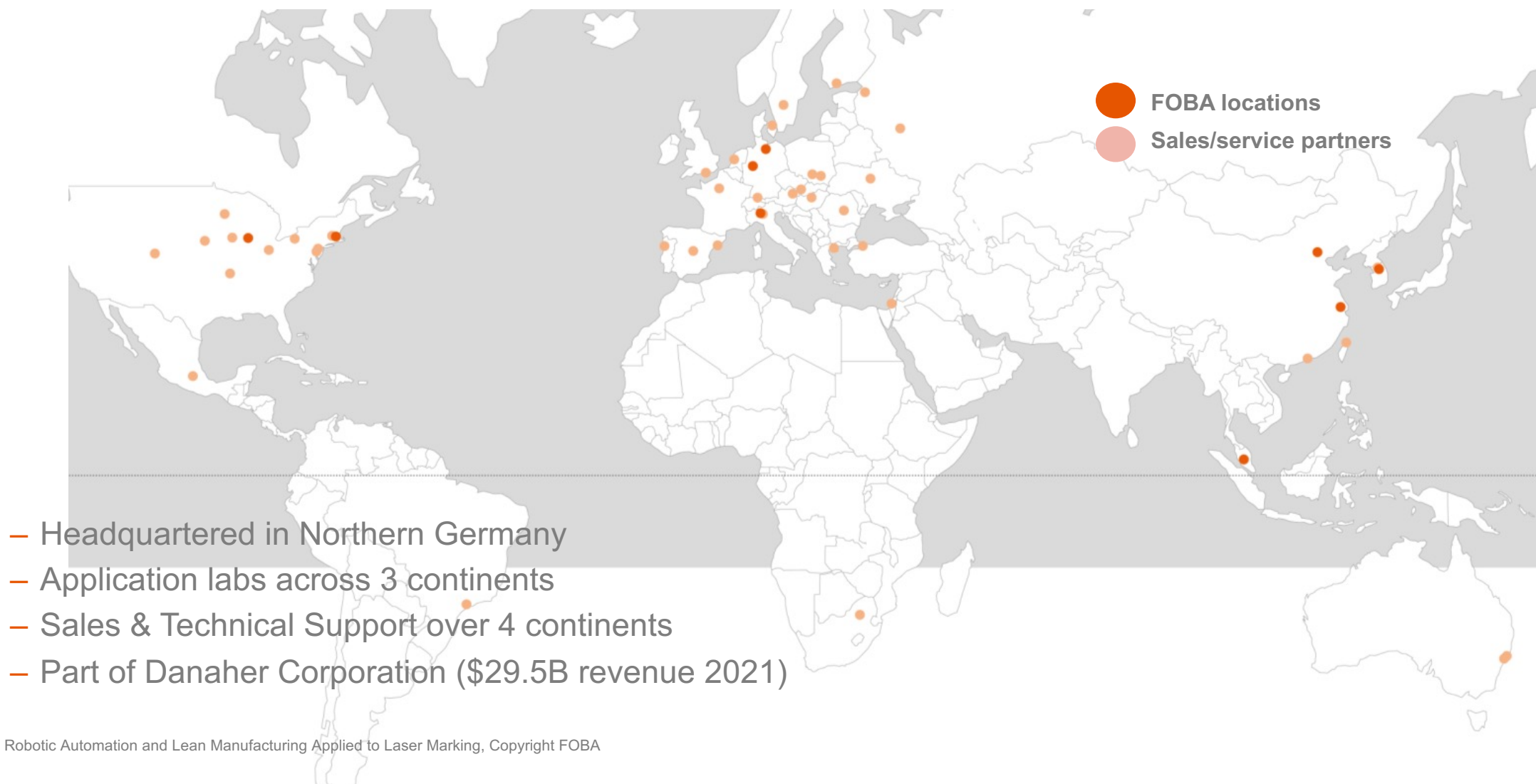
**Flexxbotics**<sup>™</sup>

# 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





# 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



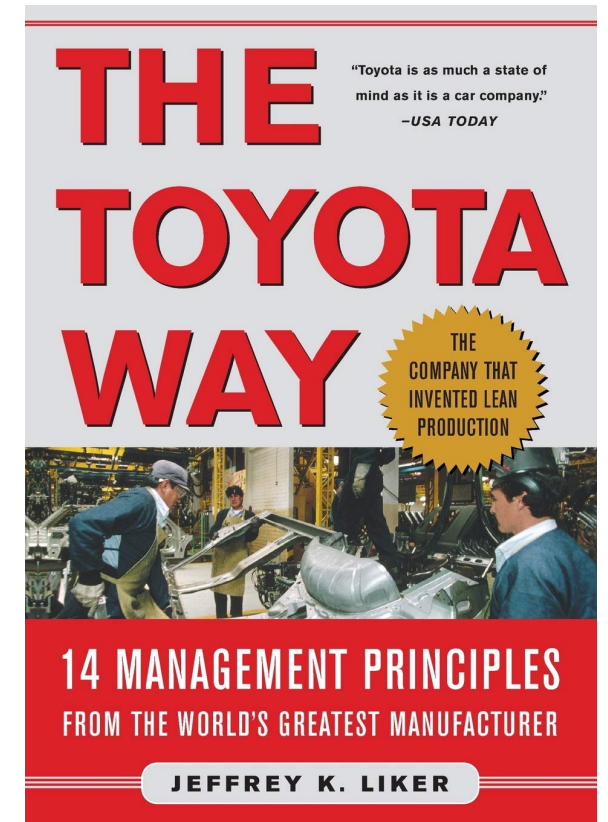
Why do people look at lean manufacturing?

TO ELIMINATE WASTE!

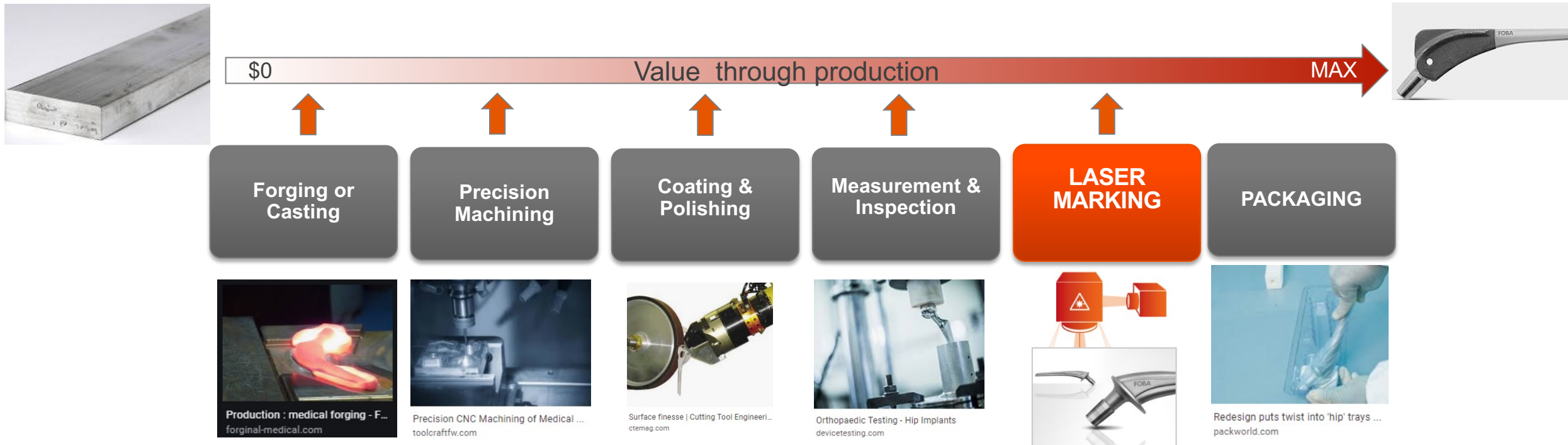
# Lean Production

**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

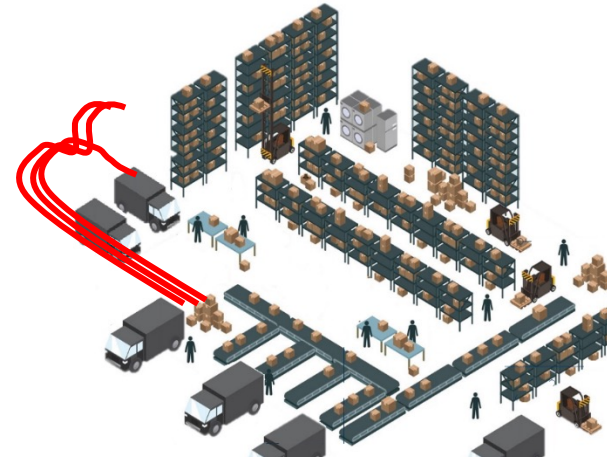


# Key Elements of Lean Manufacturing

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

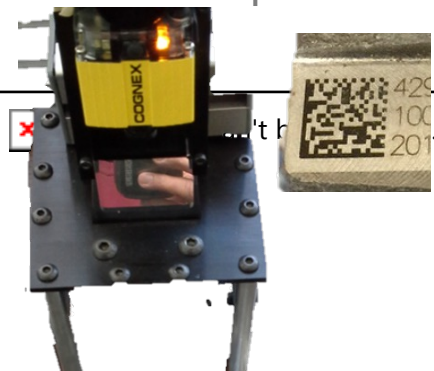


Jake Brake, is an engine braking mechanism installed on some diesel engines to slow down trucks going down hill.

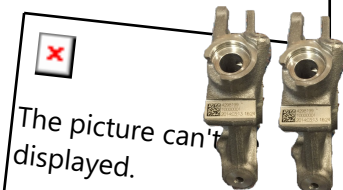
# Automotive Example: Braking component

## Shared station

2D code Inspection 20sec



## Outgoing parts

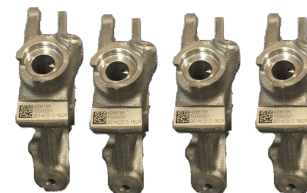


The picture can't be displayed.

The picture can't be displayed.

Laser Marking 12 sec

The picture can't be displayed.

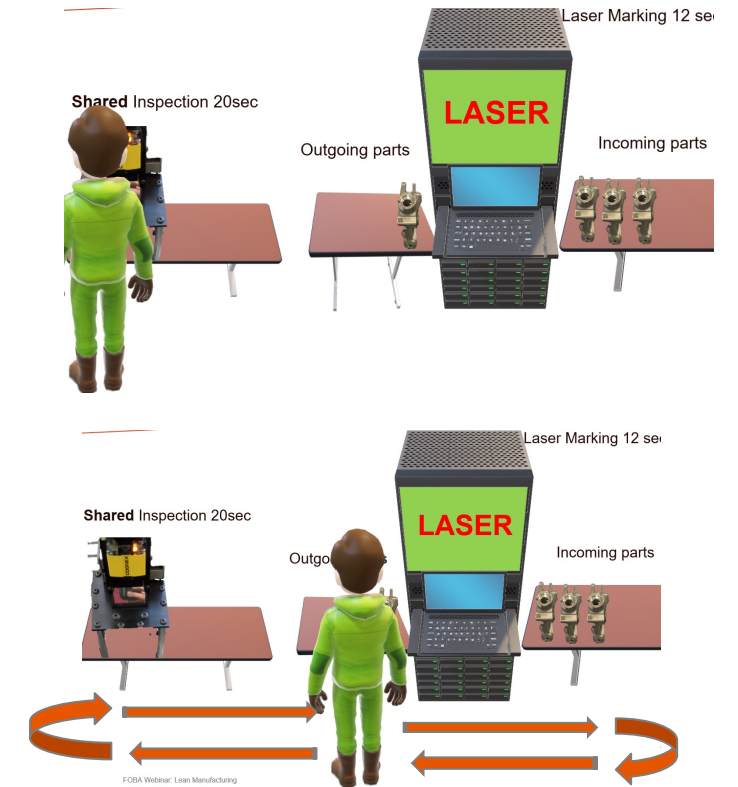


Laser mark time 12 Sec w. load/unload  
Mark inspections station: 20 sec  
Travel time between stations: 15 sec

**TOTAL 47 sec**

### 3 Lean challenges:

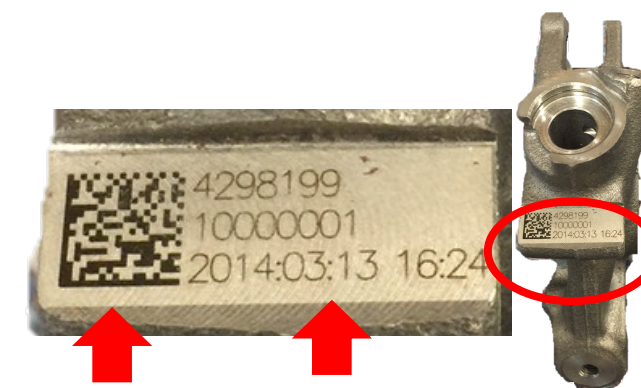
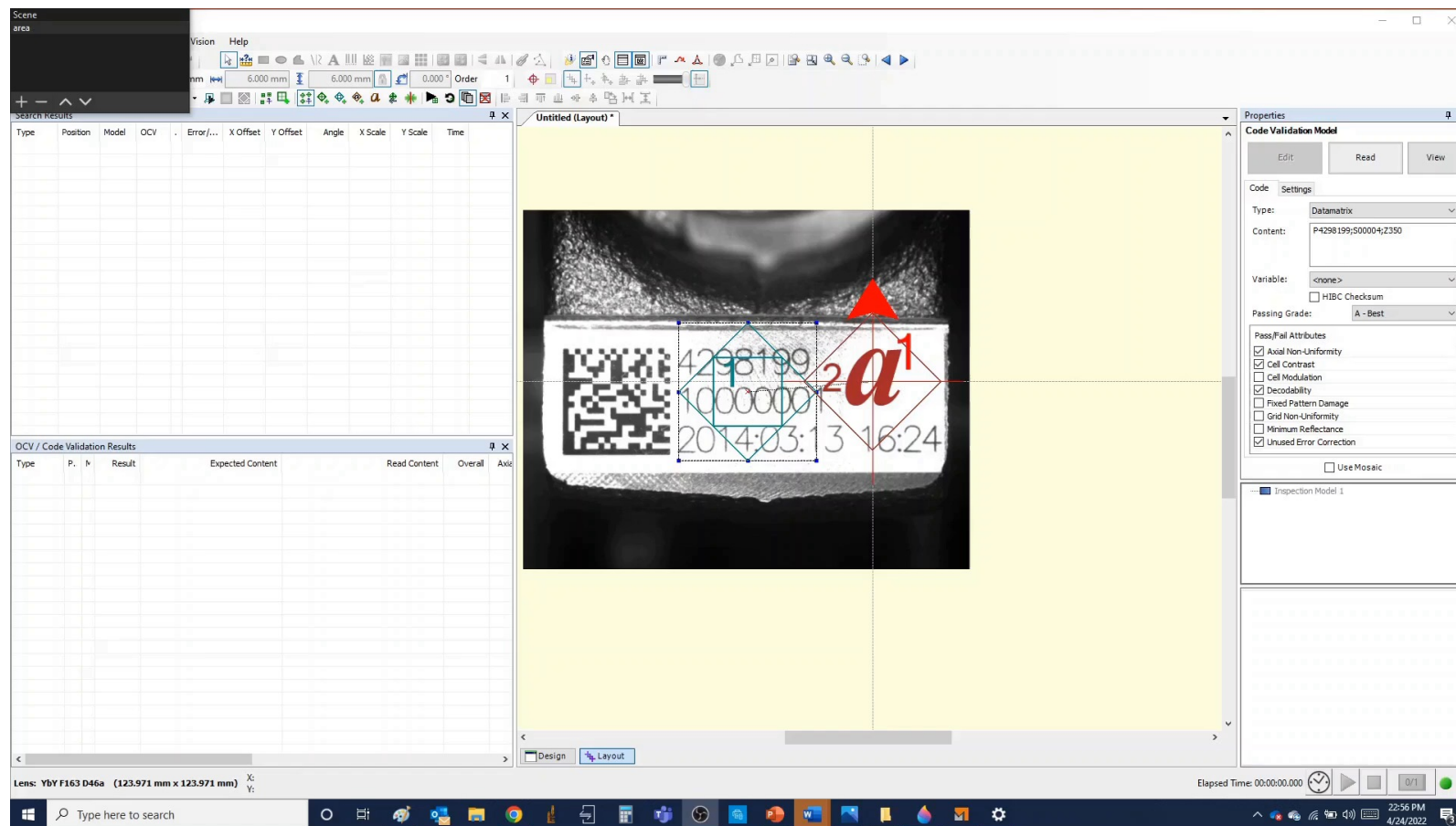
1. **Waiting time** at code validation station 20 sec (50% of process)
  1. **Inspection time** 20 sec
  2. **Shared station**
2. **Motion** travel to different stations 15 sec
3. **Extra processing** : Handling part to the Inspection
4. ~~Defects~~
5. ~~Transportation~~
6. ~~Inventory Waiting~~
7. ~~Overproduction~~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



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



# Solution: Fully Integrate Code validation in the laser



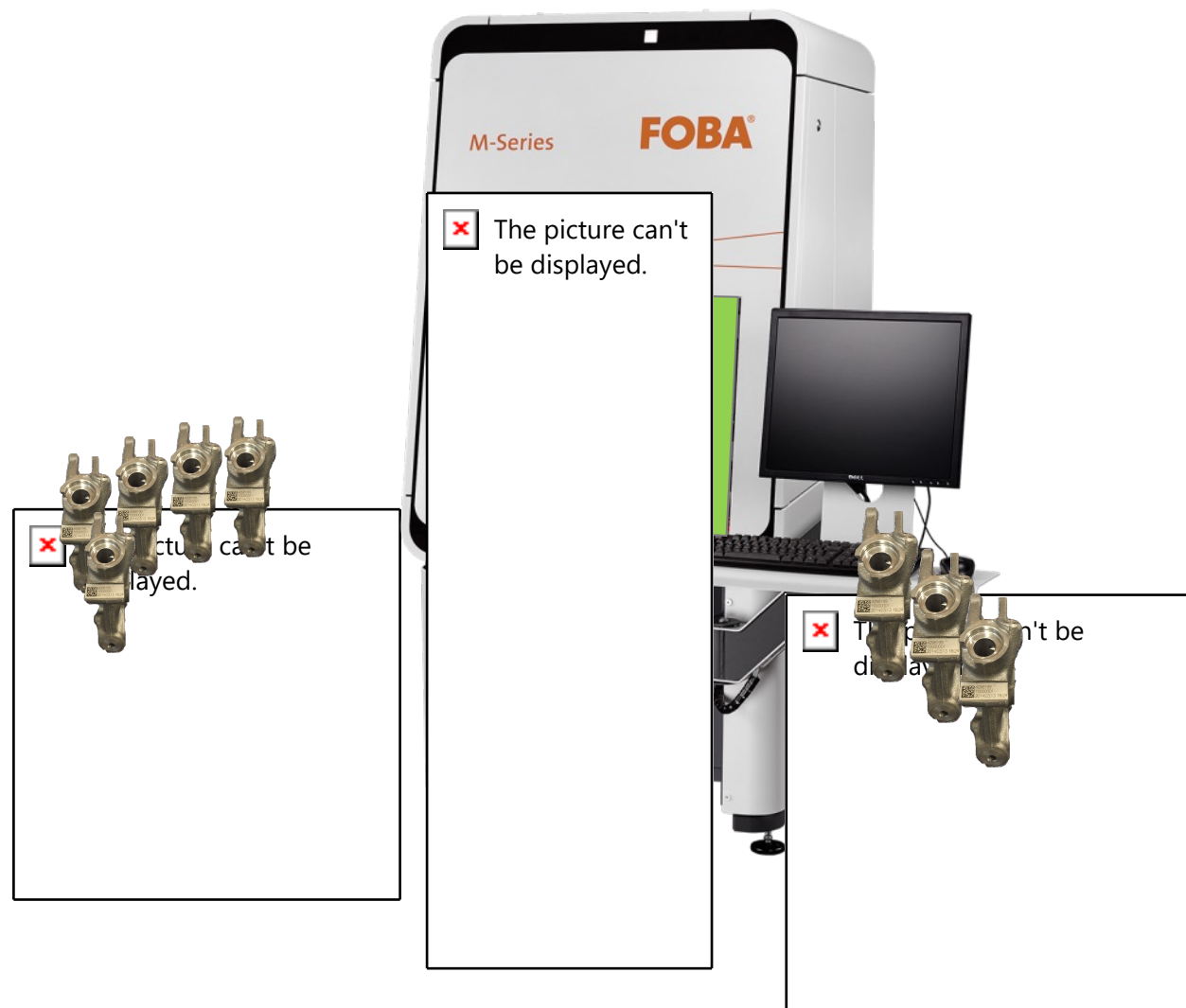
Machine  
readable

Human  
readable

**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



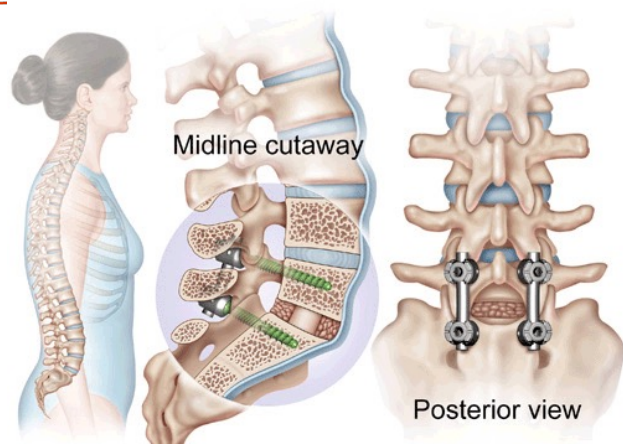
Assembled brake



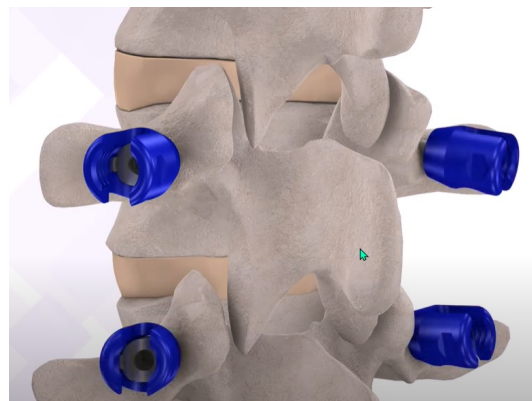
<https://www.todaysemobility.com/article/tmv0915-foba-laser-marking-traceability/>



# Medical Case: Medical Implant Marking



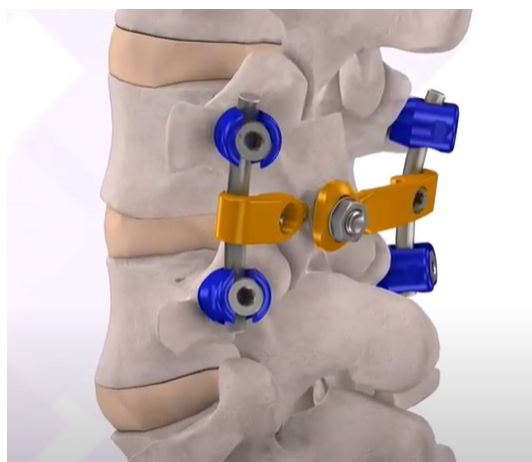
Bone Spine Surgery.  
<https://www.wayncheng.com/>



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 →



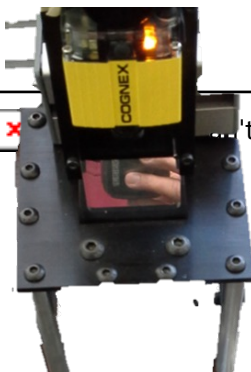


## Case 2 : Pedicle screw marking process (10 per tray)

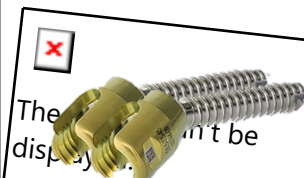
2D code  
Inspection  
60 sec

Microscope  
text inspection  
60sec

✗ The  
picture  
can't be  
display  
ed.



Outgoing parts



✗ The  
display  
can't be

✗ The picture can't be  
displayed.

✗ The picture can't  
be displayed.

Laser Marking 50 sec

✗ The picture can't be displayed.



Laser mark time 50 Sec

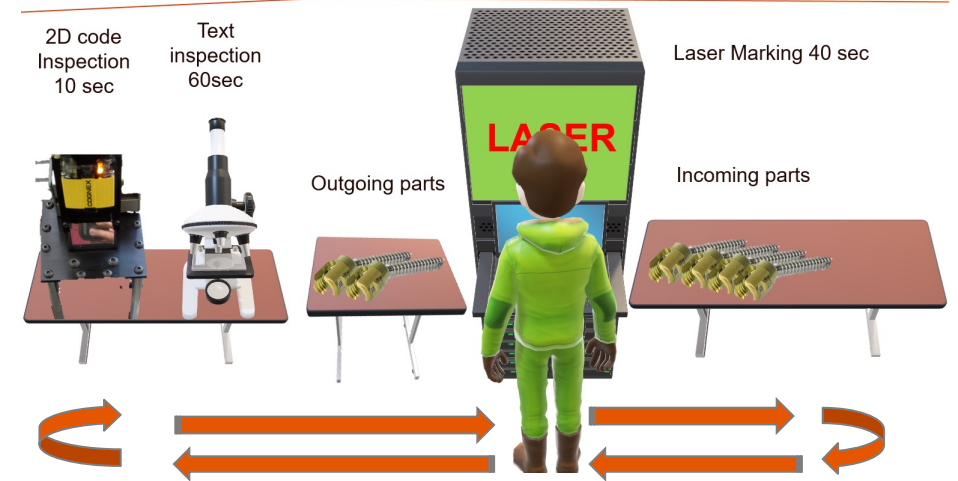
Mark inspections stations: 120 sec

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 displays the MarkUS! Designer software interface. The main window shows a camera view of a laser-marked part with a QR code. The part is labeled with the text "PS5.5-7.5-45" and "10744-09". A large red "a1" is overlaid on the image. The software interface includes a menu bar, a toolbar, and a search results table. The search results table shows the following data:

Type	Position	Model	OCV	Error/...	X Offset	Y Offset	Angle	X Scale	Y Scale	Time
Datamatrix	1	1	PASS							
Datamatrix	1	1	PASS							
Datamatrix	1	1	FAIL							

The properties panel on the right shows the Code Validation Model settings. The Code Type is set to Datamatrix, and the Content is set to ~1010081235202042710110744-09. The Variable is set to <none>, and the Passing Grade is set to C - Fair. The Pass/Fail Attributes section includes checkboxes for Axial Non-Uniformity, Cell Contrast, Cell Modulation, Decodability, Fixed Pattern Damage, Grid Non-Uniformity, Minimum Reflectance, and Unused Error Correction. The Use Mosaic checkbox is also present.



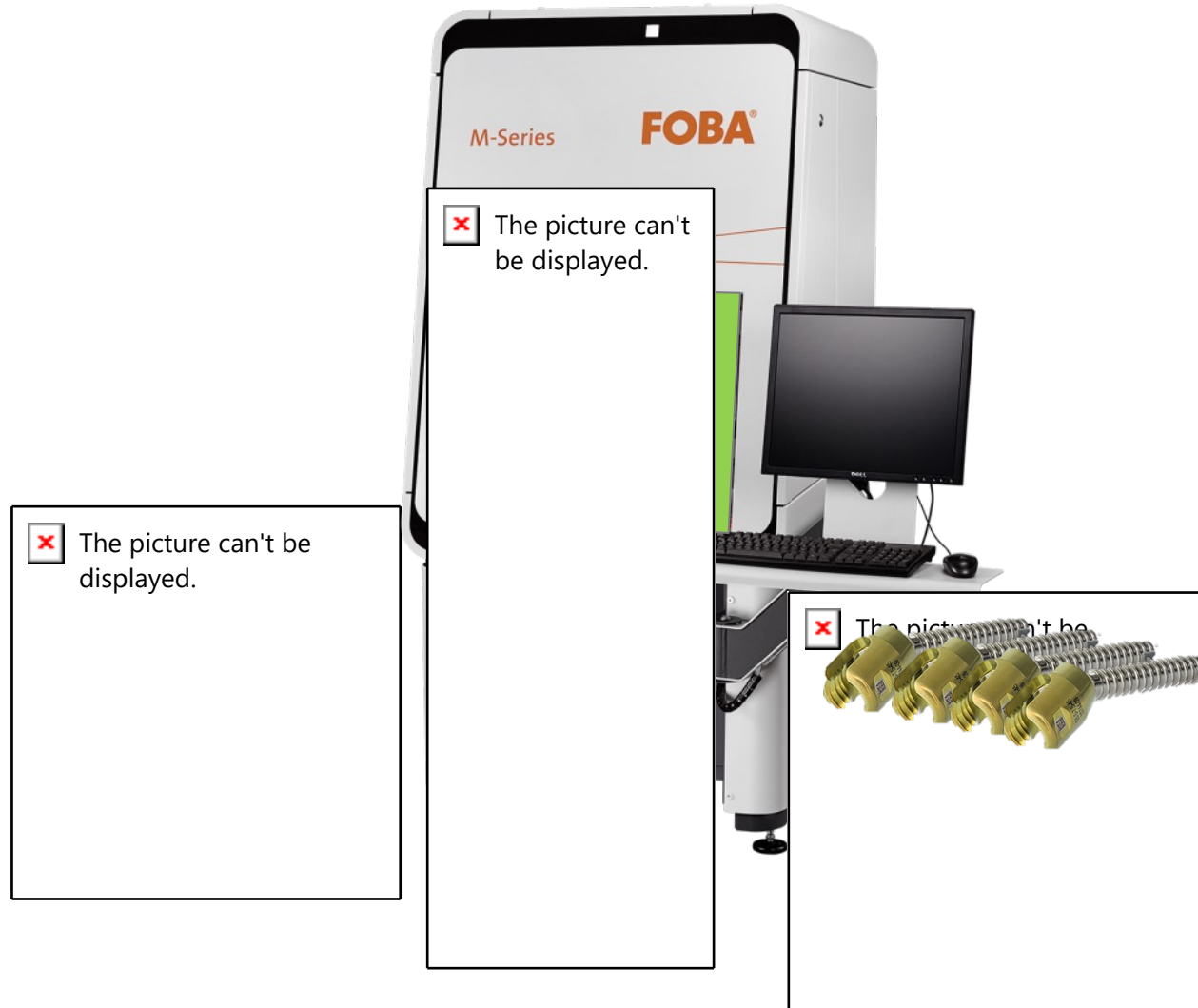
Machine readable

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:

Dr. Faycal Benayad-Cherif,  
[faycal.benayad@fobalaser.com](mailto:faycal.benayad@fobalaser.com)

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