



Italy
...since 1958



**Customization and Automation
Updates in MPI and FPI in the
Aerospace and MRO Industries
Since 1958
Milan, Italy**

**Greg Monks – Level 3 NAS 410 MT&PT
CGM USA**

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The Company – History

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1958

CGM was established in 1958 as a one-man company by Mr. Corrado Gianni.



1972

First facility in Opera, Milan.

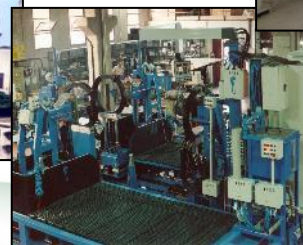


Production of MT, PT system and accessories



1980

Second and last facility in Opera, Milan

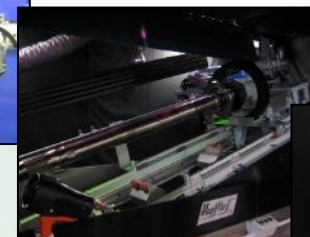
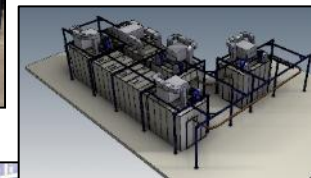


Production of Semi-Automatic MT & PT Systems



1990

Production of Contactless in-line high productivity MT System and fully automatic PT Systems



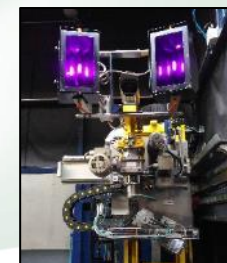
2000

FWDC 3-phase MPI system for Aerospace special application



TODAY

Using HD Cameras for the remote inspection with several application fields

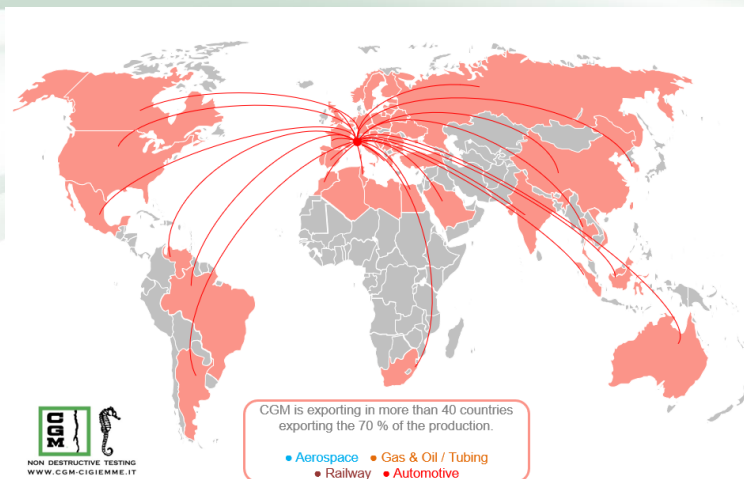


Service

An internal TEAM of skilled and specialized engineers ensures rapid and appropriate service worldwide.

Internationality

We export 70% of our Systems through a worldwide trading network of 25 independent representative organizations.



CGM is exporting in more than 40 countries exporting the 70 % of the production.

- Aerospace
- Gas & Oil / Tubing
- Railway
- Automotive

Experience & Know-how

More than **55 years** of experience in the field of **Non Destructive Testing** as Magnetic Particle Inspection and Liquid Penetrant inspection Systems.

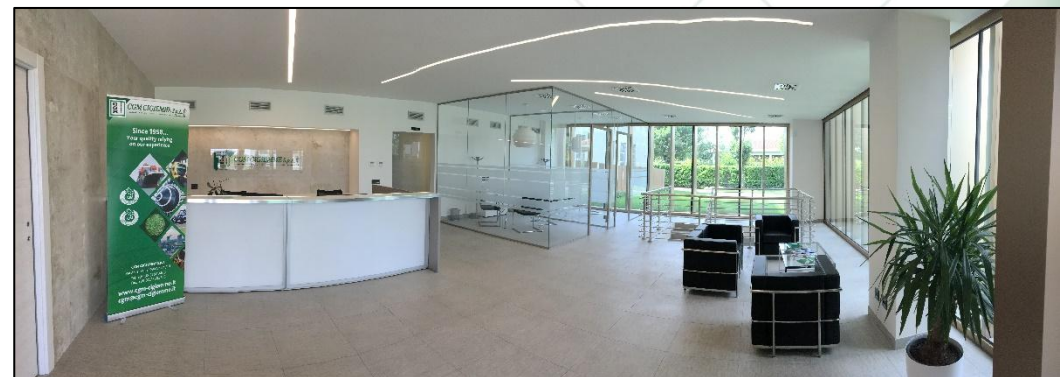


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CGM Headquarters and Production Facilities



Welcome



Workshop N.1

Workshop N.2





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American customers

Service in the
USA – CANADA – MEXICO



Q.C. Technologies, Inc



CIGIEMME
NON DESTRUCTIVE TESTING





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Magnetic Particle Systems for the inspection of internal and external surfaces of compressor or turbine shafts

REFERENCE STANDARDS

ASTM E E1444_E1444M-25

ASTM E 3024 -22

E1417_E1417M-21

AS7114_1A - NADCAP requirements



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Two versions: Semi Automatic or Fully Automatic

Main features:

- 15° inclination for liquid drainage
- 2-coils flange magnetization
- Automatic inserting of the central conductor
- Internal inspection without removing the shaft from the MPI bench
- Automatic endoscope translation together with shaft rotation



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CEM 3000 2x400

INSPECTION INTERNE

- Indirect magnetization and operator avoids touching the shaft through the whole magnetizing and inspection cycle
- Automatic internal surface inspection cycle + the possibility to move manually the endoscope
- Possibility to record the internal inspection
- Possibility to save the position of the internal indication
- Inspection report in PDF part by part with pictures of indications



CIGIEMME
NON DESTRUCTIVE TESTING

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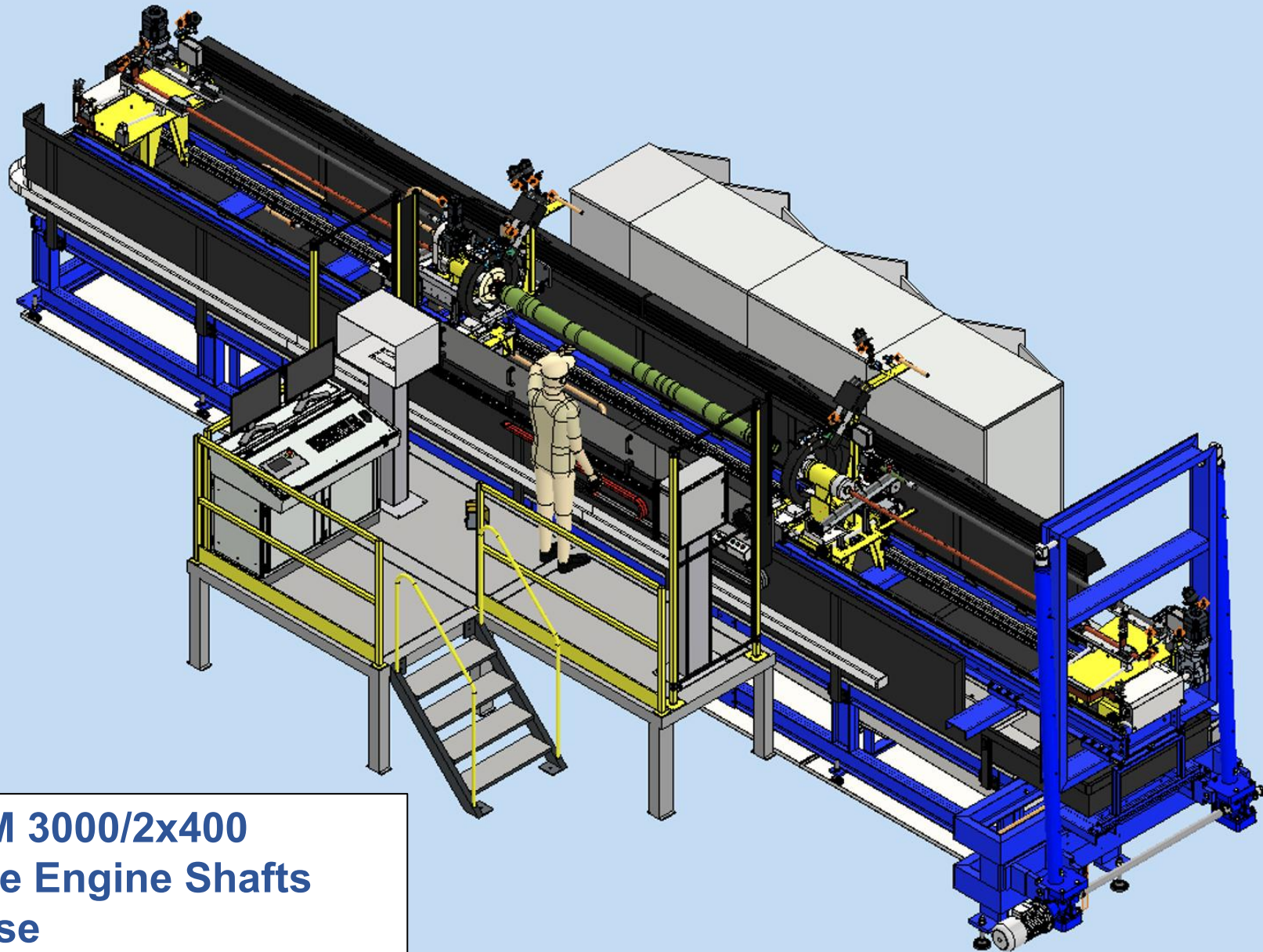


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**CRT Cleveland
USA**



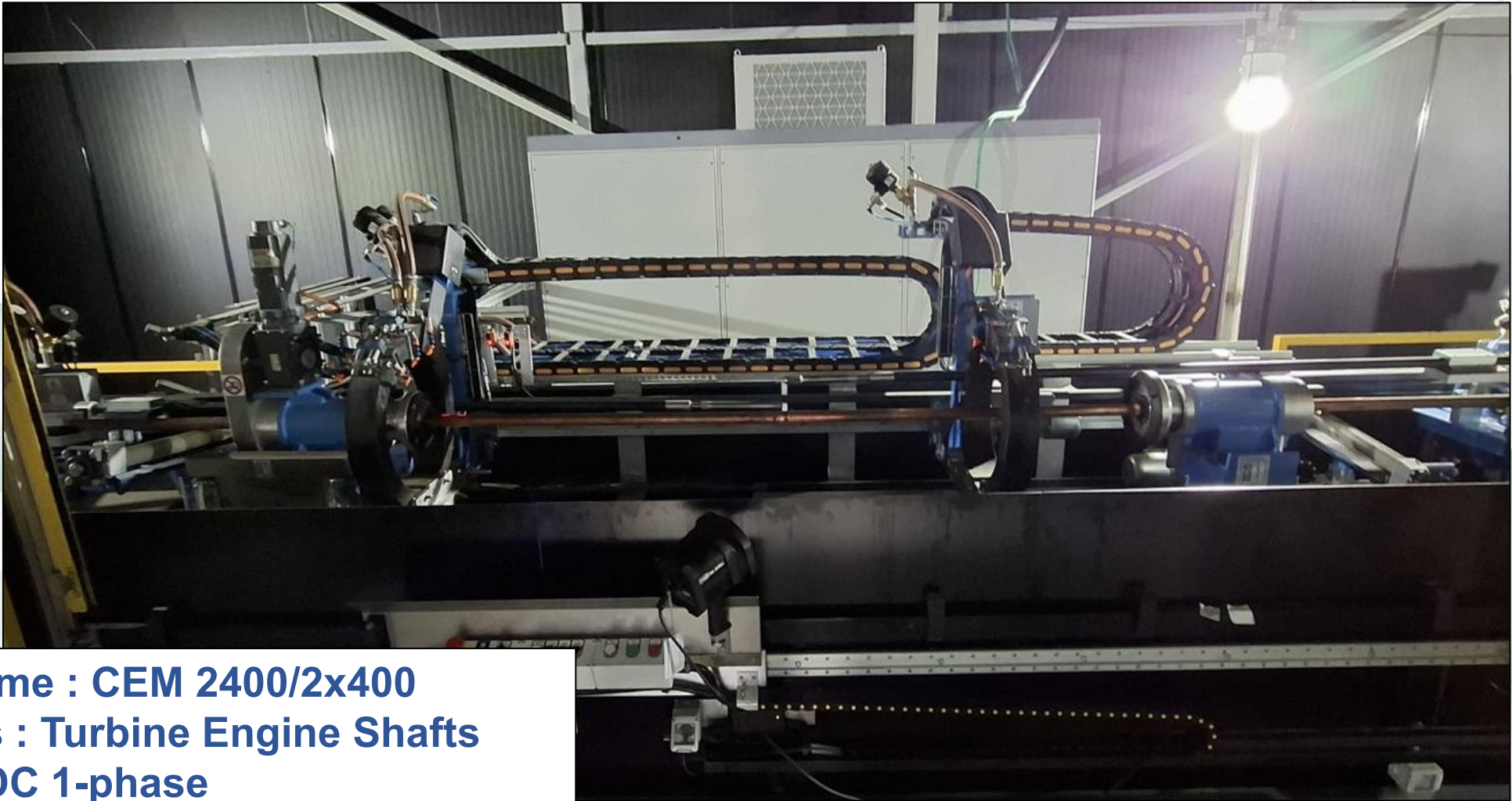
MPI System Name : CEM 3000/2x400
Inspected parts : Turbine Engine Shafts
AC-HWDC-FWDC 3-phase





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TATA India



MPI System Name : CEM 2400/2x400
Inspected parts : Turbine Engine Shafts
AC-HWDC-FWDC 1-phase



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**Lufthansa Technik
Hamburg - Germany**



MPI System Name : CEM 2500/2x400
Inspected parts : Turbine Engine Shafts
AC-HWDC-FWDC 3-phase





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SNECMA China



MPI System Name : CEM 2500/2x400
Inspected parts : Turbine Engine Shafts
AC-HWDC-FWDC 3-phase





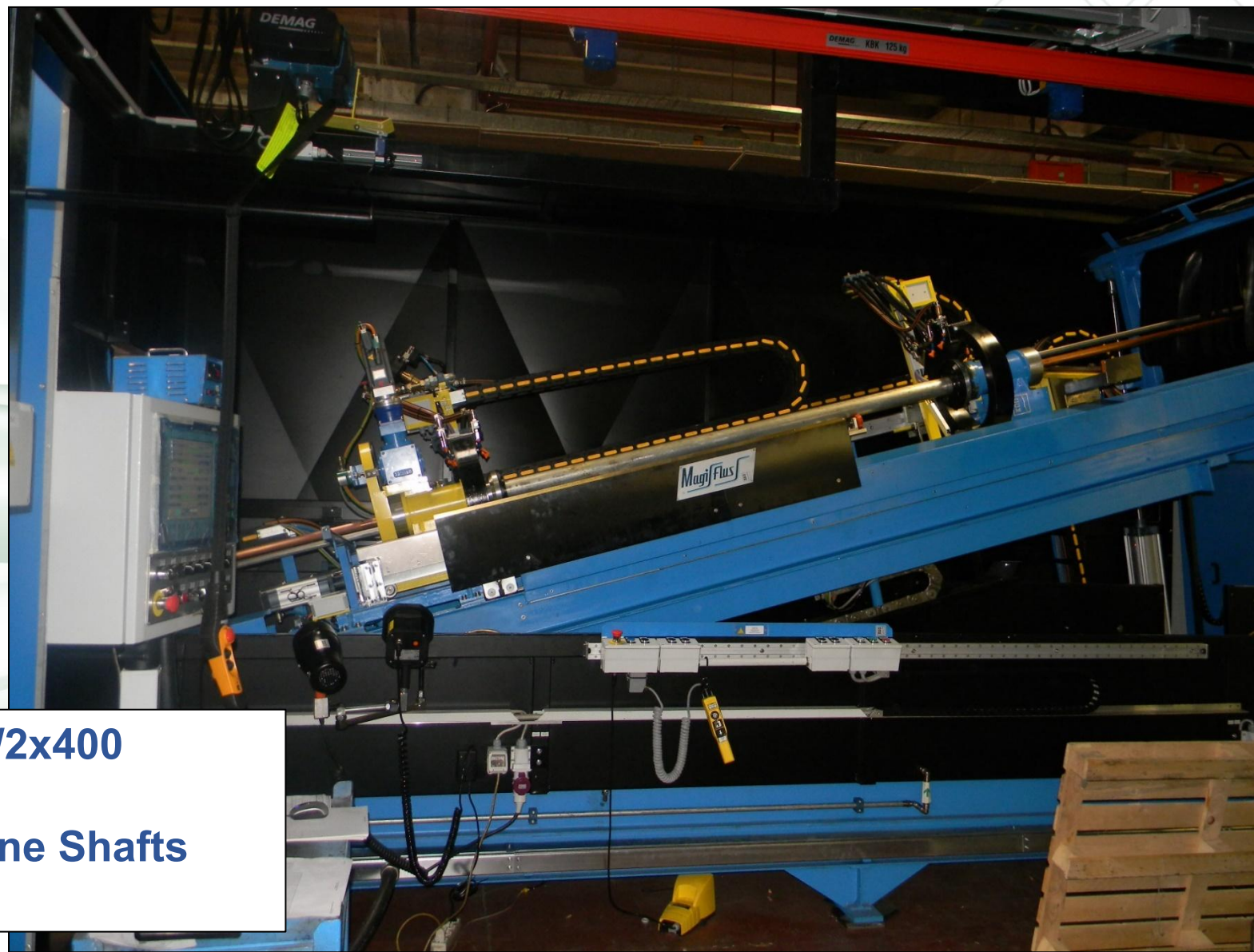
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Safran SNECMA
France Corbeil
2 MPI units



MPI System Name : CEM 2500/2x400
Fully Automatic with HMI
Inspected parts : Turbine Engine Shafts
AC-HWDC-FWDC 1-phase



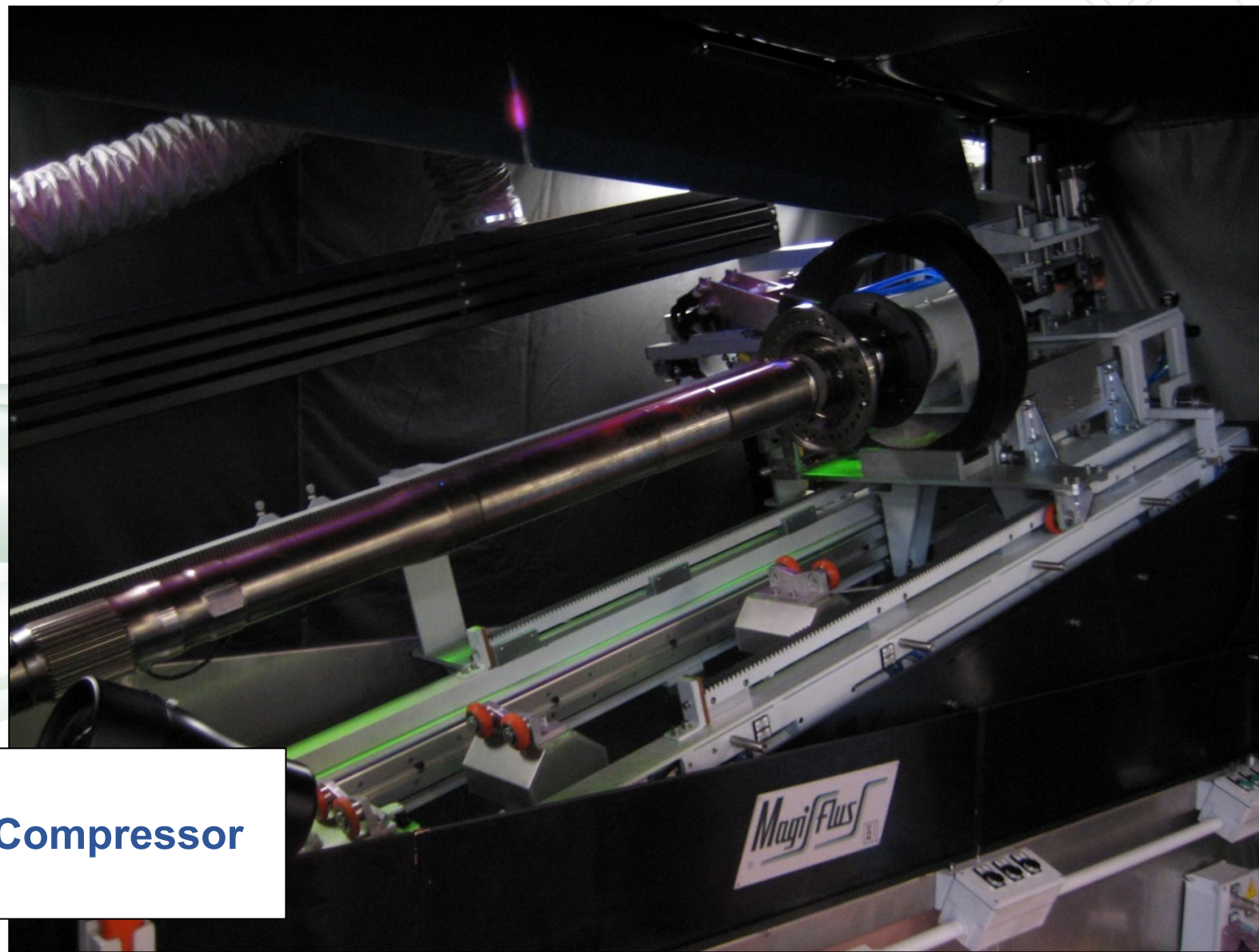


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SNECMA China



MT System: CEM 1800/2x400
Inspected parts : Turbine and Compressor
AC-HWDC-FWDC 1-phase



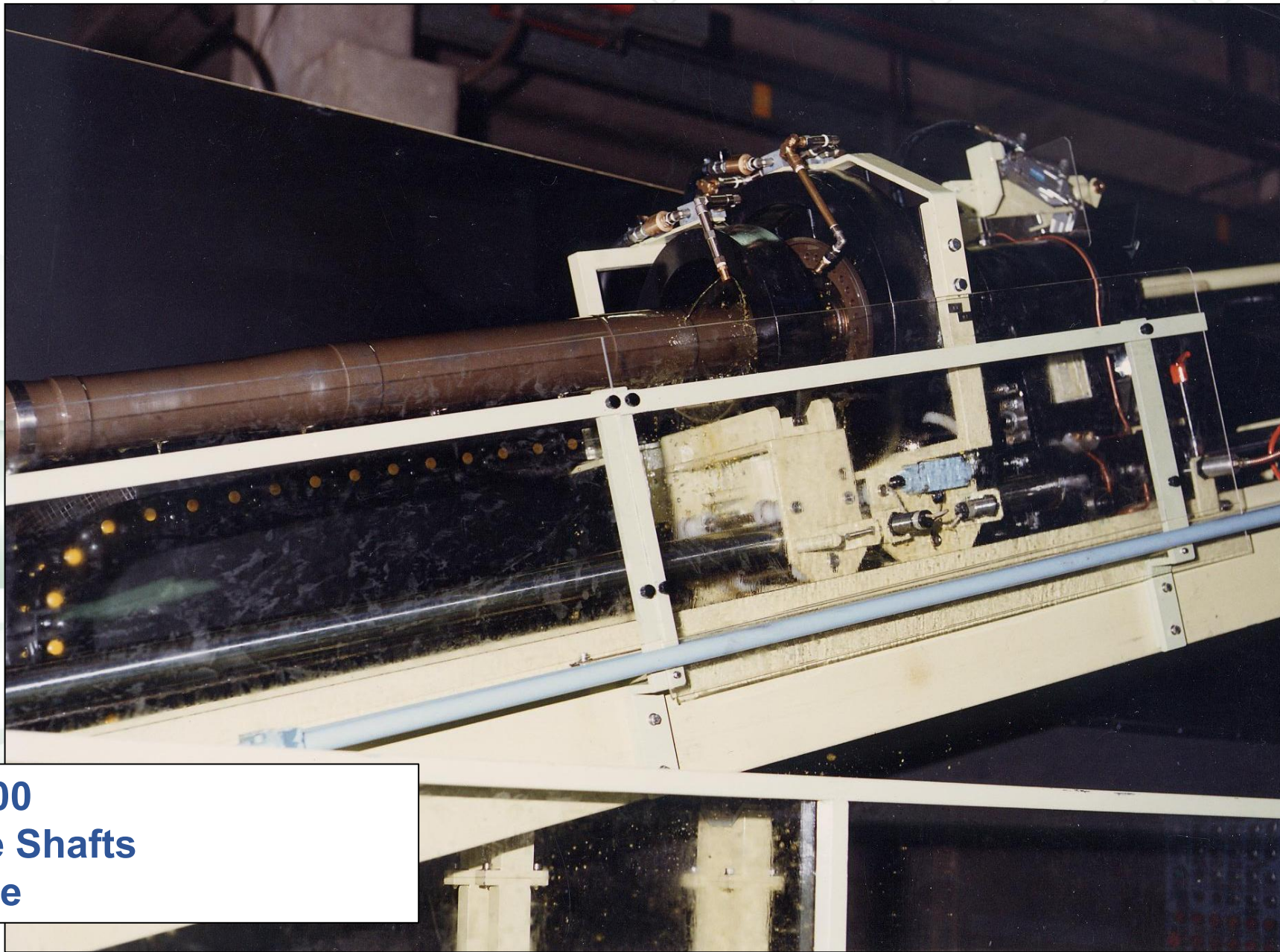


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France
Safran SNECMA
Corbeil



MT System: CEM 1800/300
Inspected parts : Turbine Shafts
AC-HWDC-FWDC 1-phase





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Customized MPI units

REFERENCE STANDARDS

ASTM E E1444_E1444M-25

ASTM E 3024 -22

E1417_E1417M-21

AS7114_1A - NADCAP requirements



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Bespoke MPI benches

MPI special systems for the inspection of landing gear components

- N.3 contact heads – max components length 3.500 mm
- N.3 movable magnetizing 5-turns coils
- Magnetic currents AC-HWDC-FWDC 3-phase



Poland



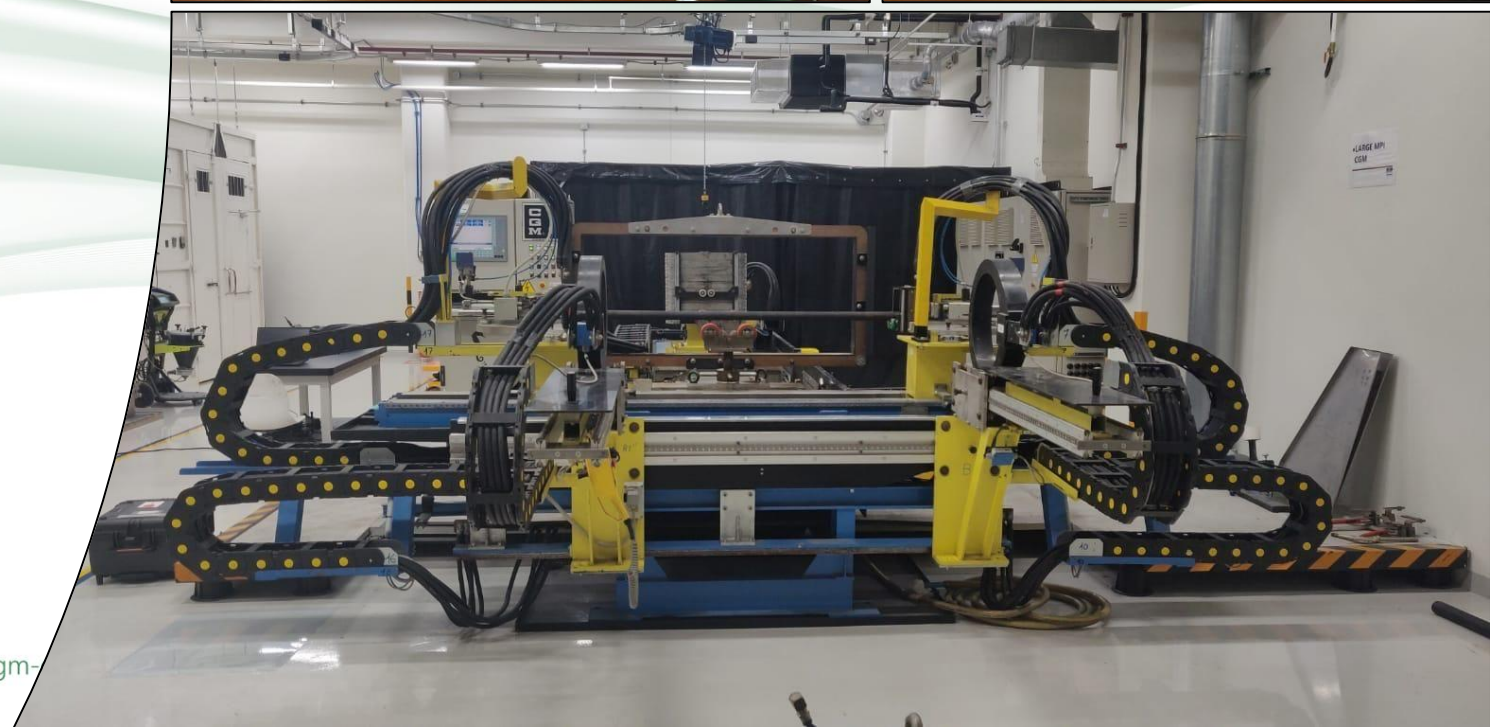
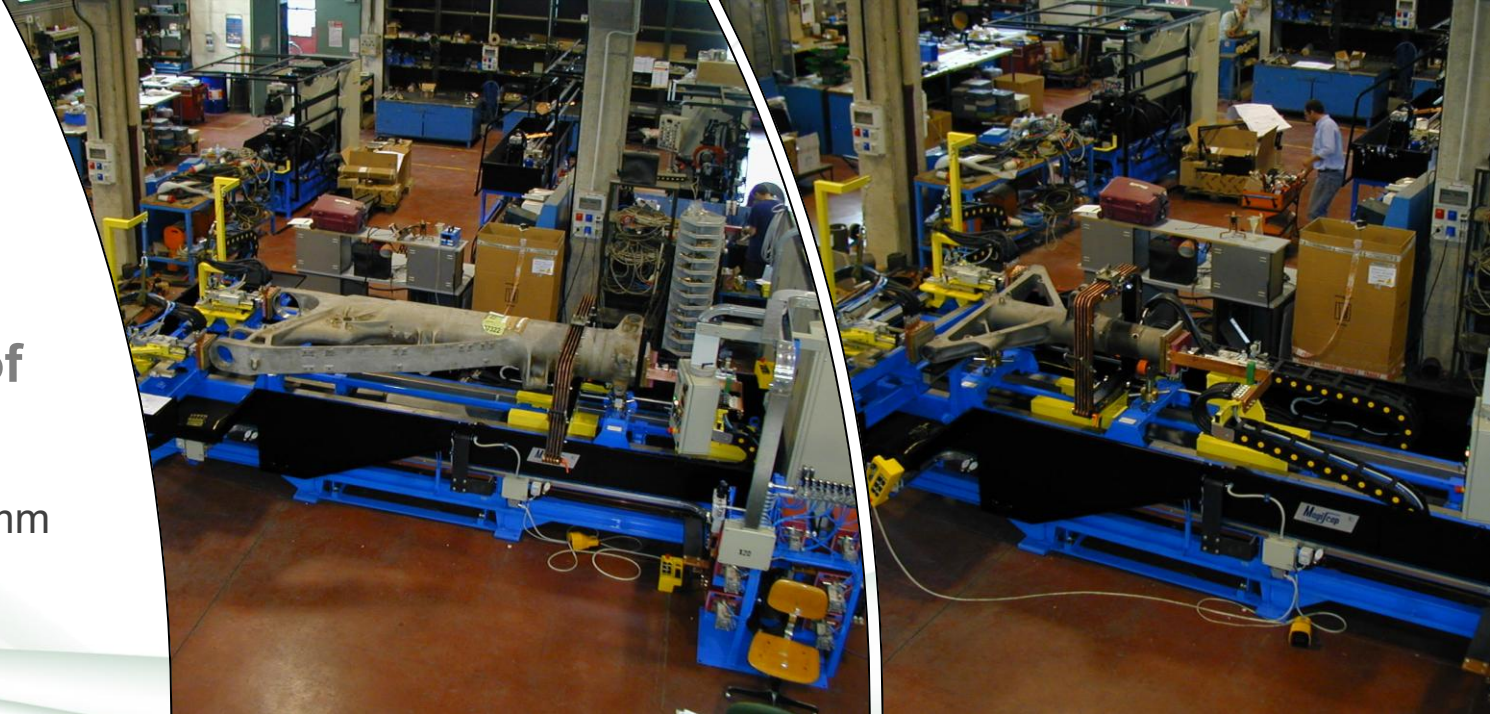
France



Thailand



www.cgm-





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Bespoke MPI benches



Magnetizing Technique

- N.3 Contact heads A-B-C
 - Current can pass A-B, A-C, B-C
- Heads B and C are tiltable to allow central conductors on holes
- Replaceable central coil with different sections



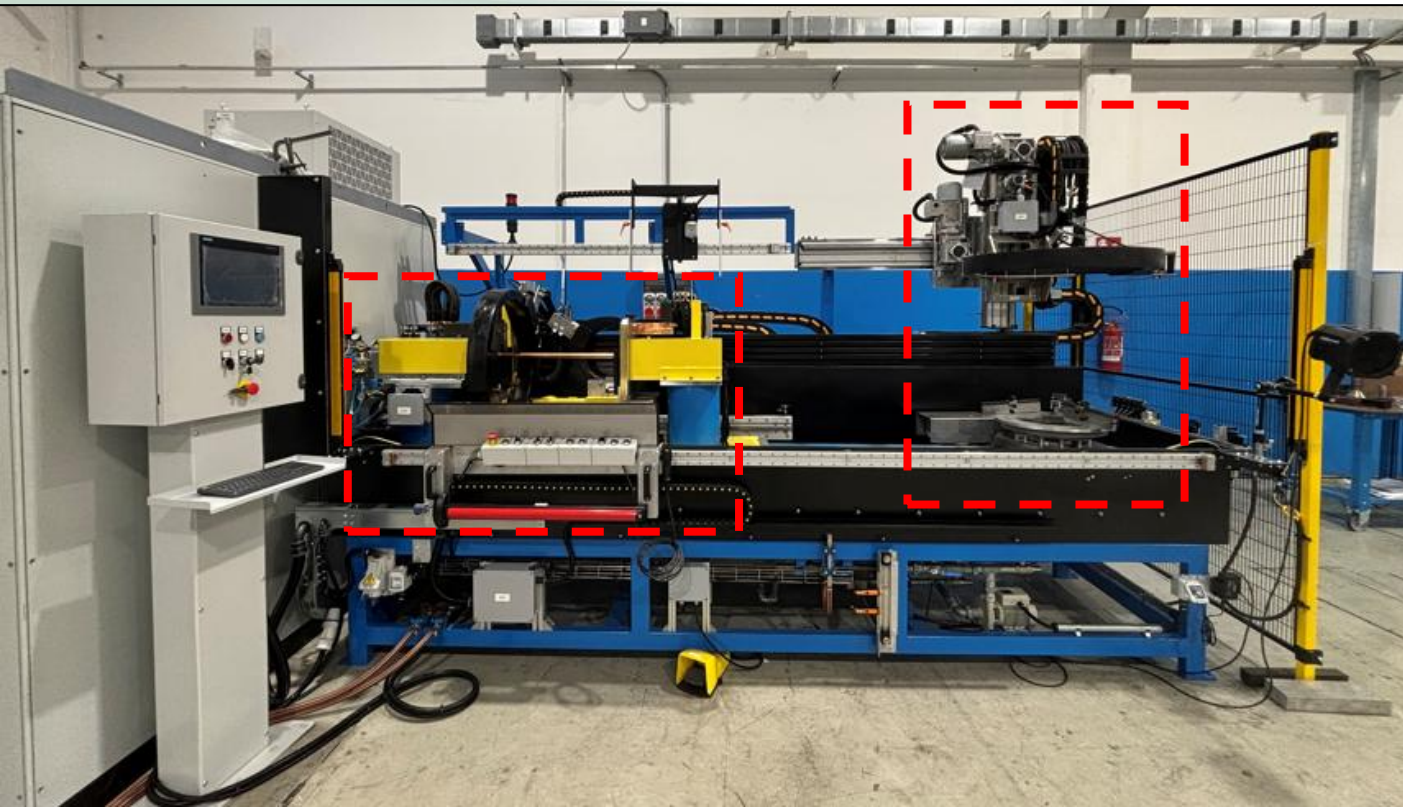


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Standard MPI benches

Two stations MPI benches

- Station N.1 – Contact + movable coil + yoke magnetization
- Station N.2 – Vertical axis magnetization for longitudinal + transversal + toroidal magnetization using the Quick Break technology in FWDC 3-phases current





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Standard MPI benches



Two stations MPI benches

- Station N.1 – Contact + movable coil
- Station N.2 – Vertical axis magnetization for + toroidal magnetization using the Quick Break technology in FWDC 3-phases current or AC





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FPI systems: manual – semi automatic – fully automatic

REFERENCE STANDARDS

E1417_E1417M-21

AS7114_1A - NADCAP requirements



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Semi-Automatic FPI systems

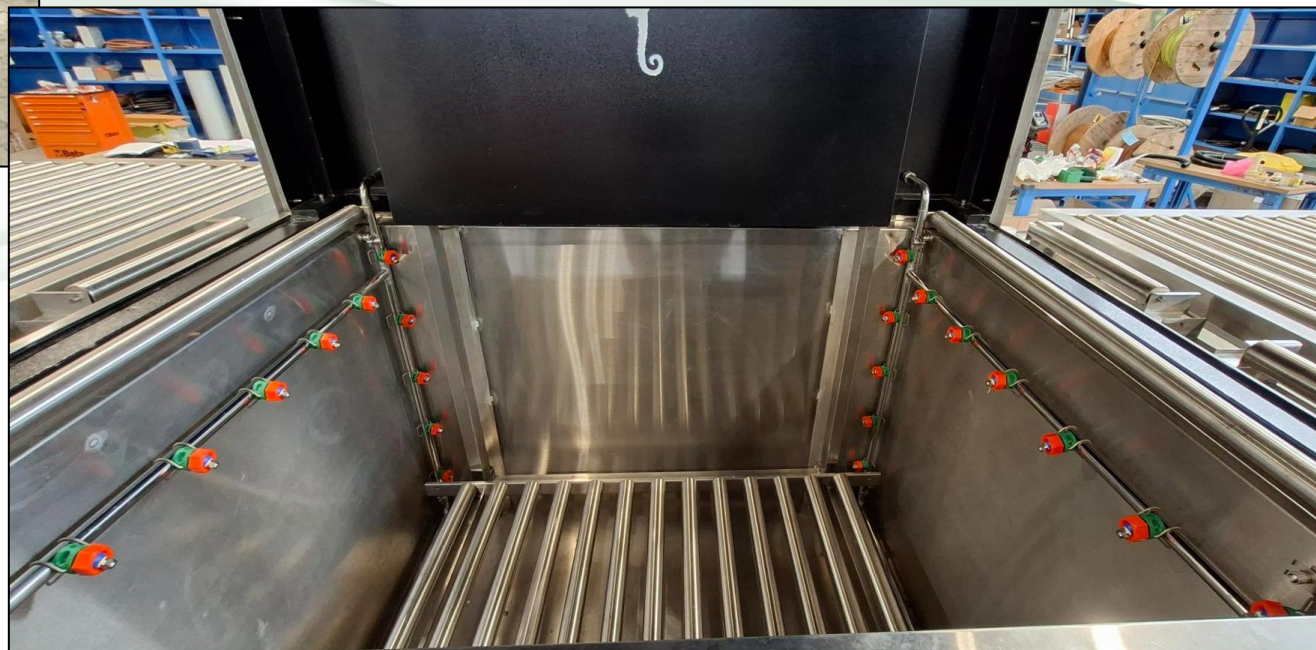


PCC Airfoils, LLC



Semi-manual FPI line

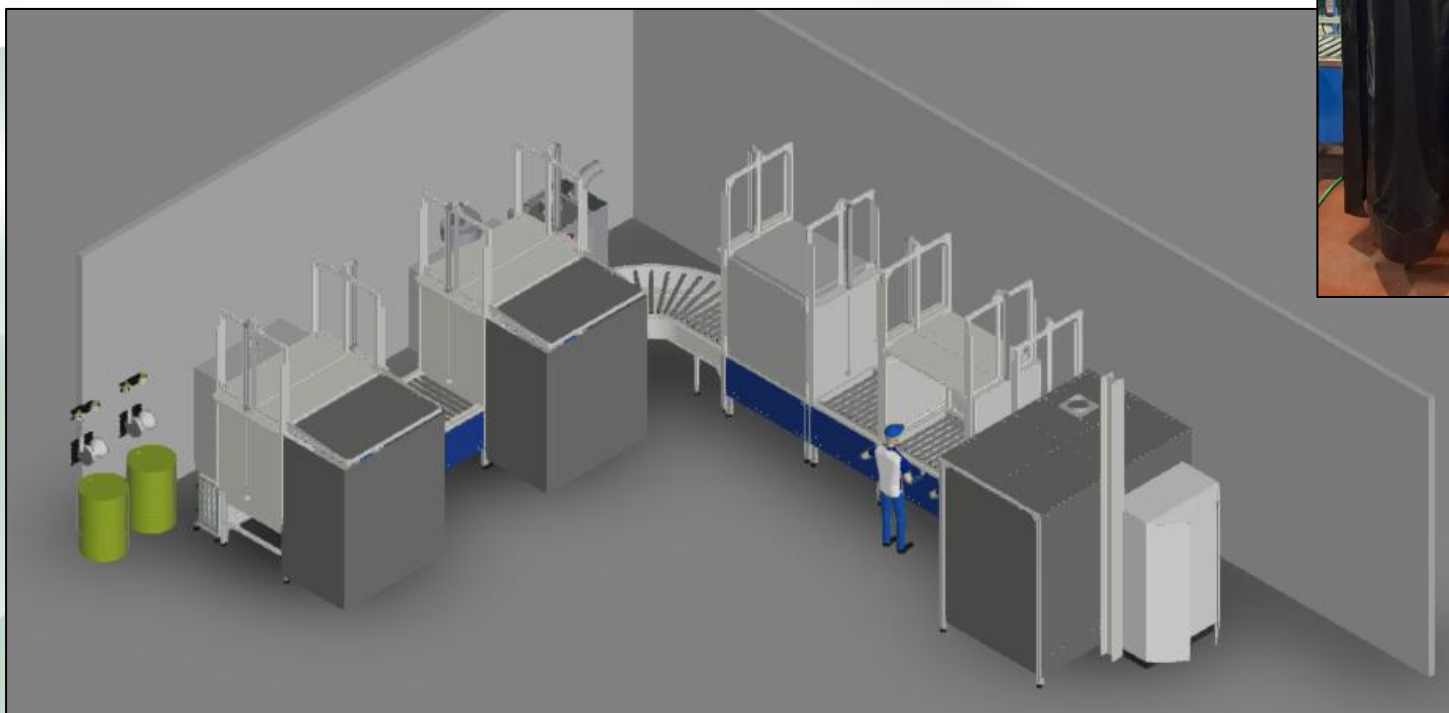
- Water wash penetrant
- Large FPI line for large turbine blades
- Automatic developer application
- Rollers conveyor solution





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Semi-Automatic FPI systems



Semi-manual FPI line

- Water wash and post emulsified penetrant
- High adjustable turning table on penetrant and washing stations
- Penetrant application by spray
- Automatic developer application
- Rollers conveyor solution



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Semi-Automatic FPI systems



FPI line for airplane wheels

- 3 different penetrants by immersion
- Pre-wash – emulsifier – post wash
- Automatic developer application
- Rollers conveyor solution

TAP AIR PORTUGAL



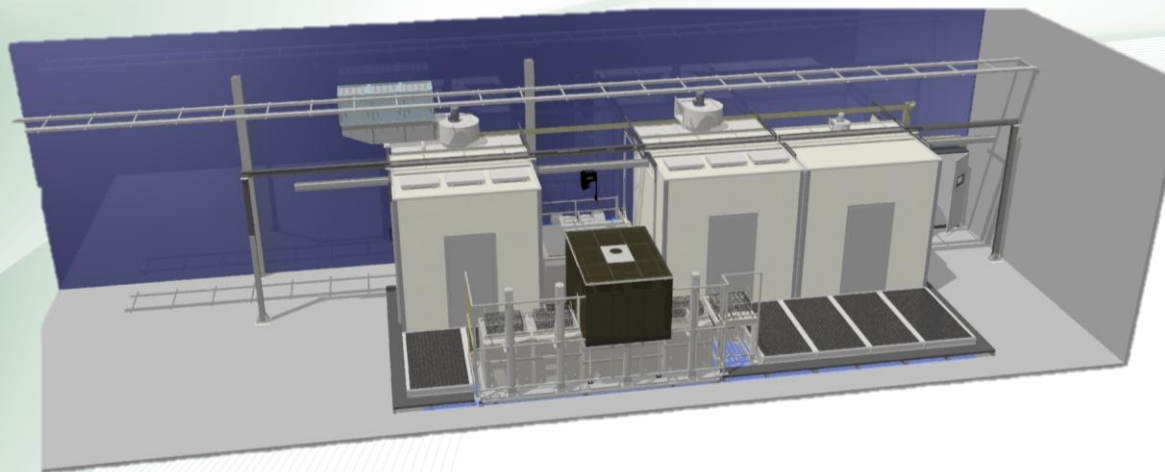


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Mix tank-cabin FPI systems

FPI system by immersion (tank) and electrostatic application in cabins

- Flexible solution for big and small pieces
- N.2 penetrant by immersion, Level II and Level III
- Three different working cabins for penetrant application, developer application and inspection
- N.1 common inspection cabin
- Ready for NADCAP certification



AUSTRALIA



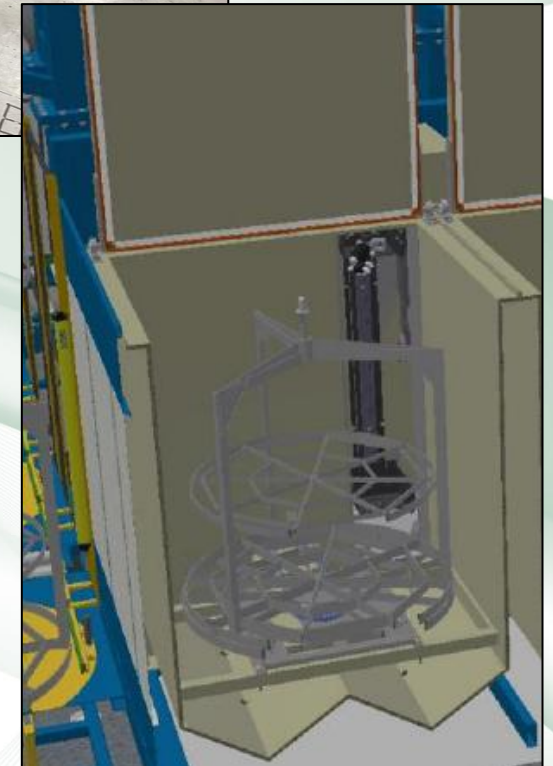


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Fully automatic FPI system

Automatic FPI system

- Automatic manipulator to move the pieces between the different stations
- New technology of penetrant electrostatic application inside the tank
- The process, excluding the inspection, is fully automatic
- Automatic developer application by electrostatic gun
- Siemens Operator Panel where to set all process parameter and recipes
- Ready for NADCAP certification
- APAVE/BUREAU VERITAS safety certified
- Tracking of all process parameters
- Possibility to print out the inspection report in PDF



Safran Blades

(Subsidiary of Safran Aero Boosters)





Morocco



India

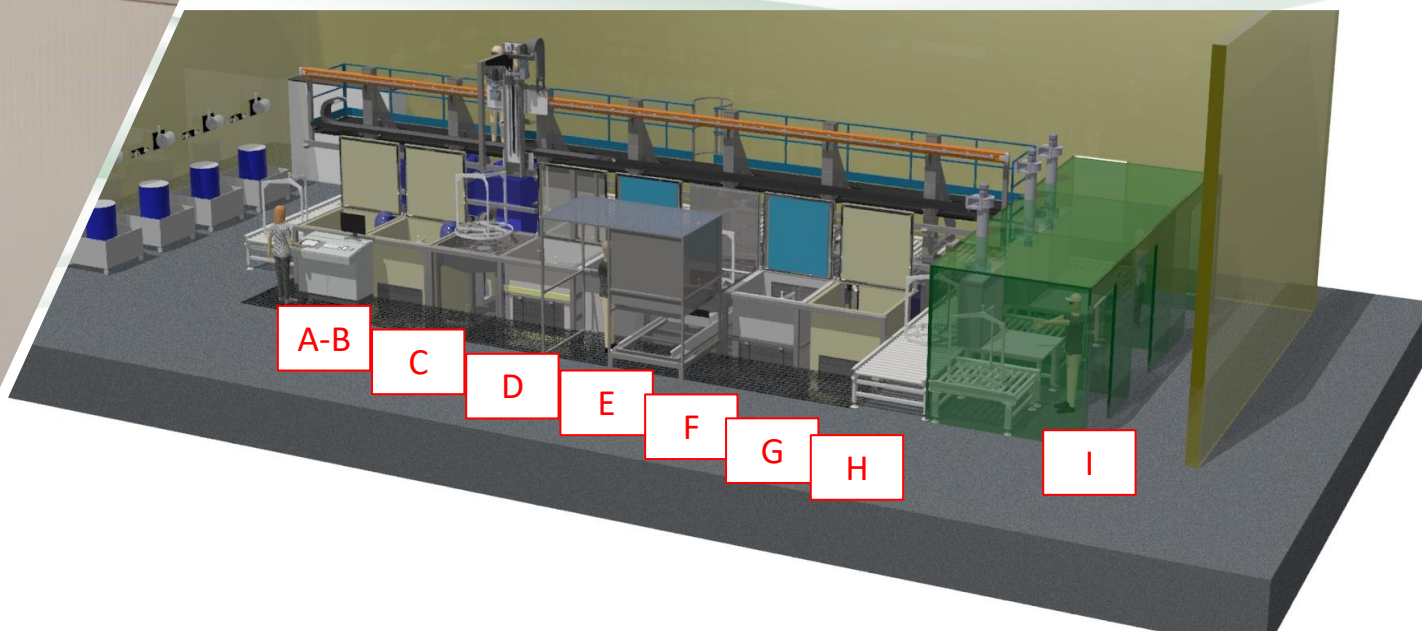


France



Line Composition

- A. Penetrant tank N.1 – electrostatic application
- B. Penetrant tank N.1 – electrostatic application
- C. Draining station
- D. Automatic Pre-rinsing
- E. Emulsifier tank
- F. Automatic final washing
- G. Drying oven
- H. Developer application – electrostatic
- I. N.3 inspection cabins



SHOT ON REDMI 9
AI QUAD CAMERA



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Fully automatic FPI system



Netherlands



Royal Dutch Airlines



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Fully automatic FPI system





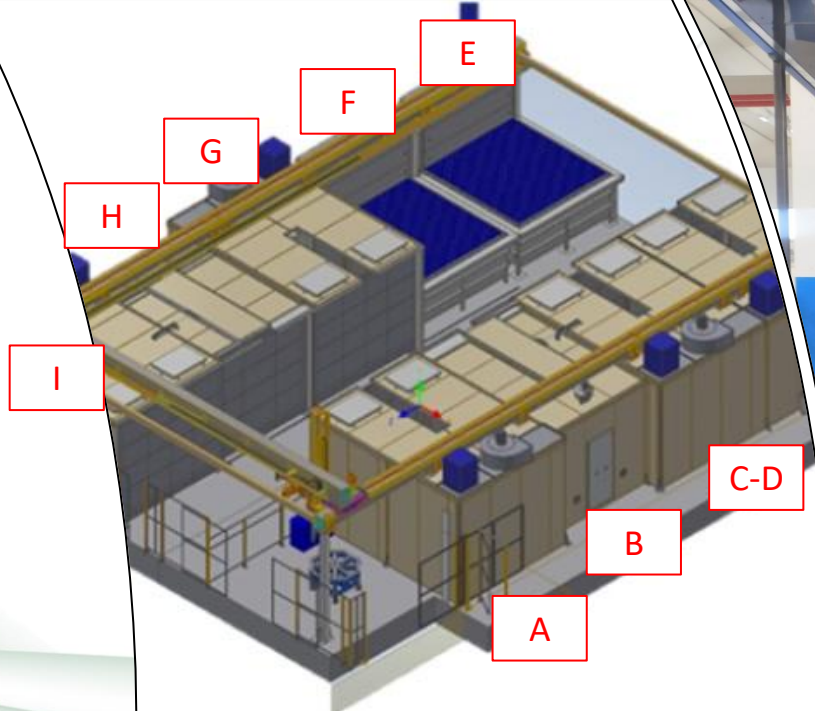
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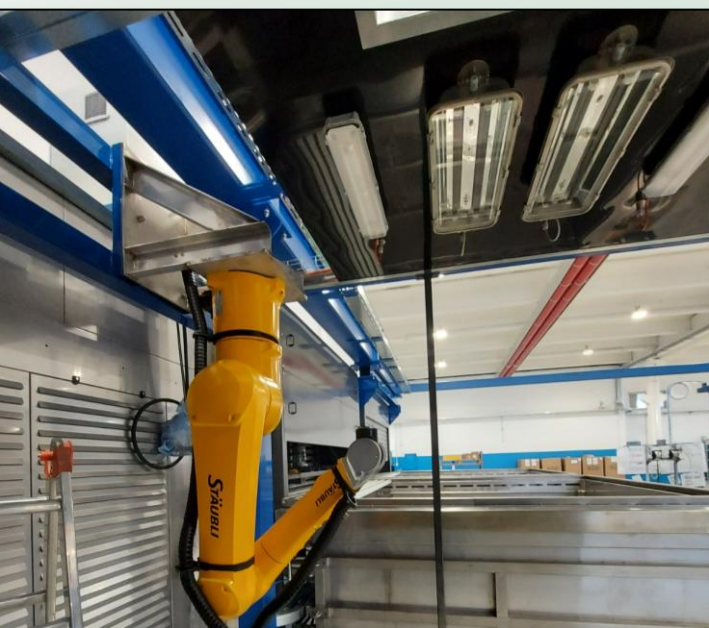
Robotized FPI system

Automatic robotized FPI system

FPI system for big parts (big rings) where the process is managed by robots

- A. Pre-cleaning (degreasing) by hot vapor
- B. Drying oven
- C. Penetrant N.1 application by robot
- D. Penetrant N.2 application by robot
- E. Emulsifier by immersion
- F. Stop bath
- G. Final washing by robot
- H. Drying oven
- I. Developer application by robot





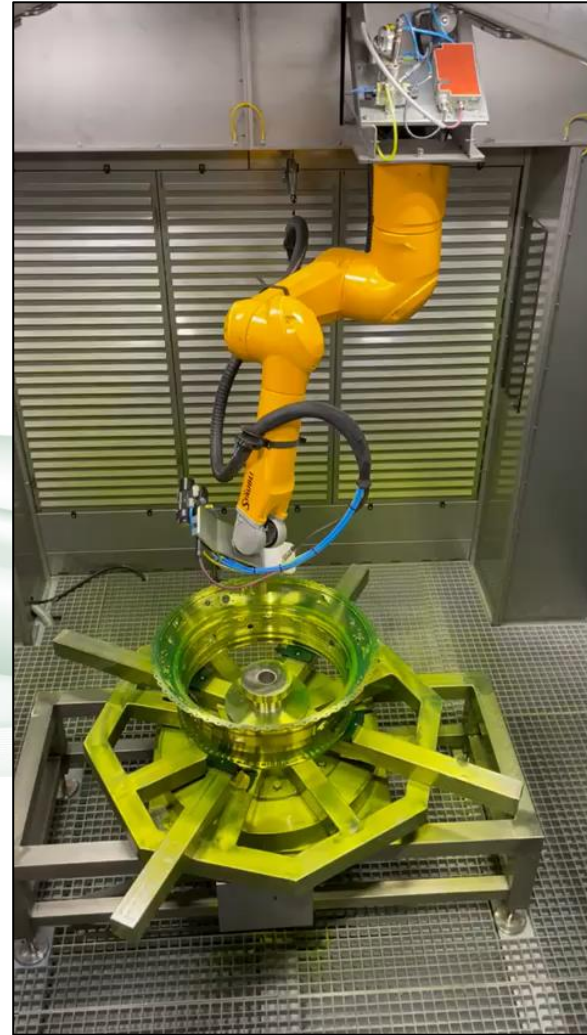


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Robotized FPI system



Penetrant application



Washing



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Automatic Defect Recognition

- **STEP N.1 → Supporting software to help the operator during the Remote Inspection**
- **STEP N.2 → Auto-learning software (Artificial Intelligence) to fully automate the process**



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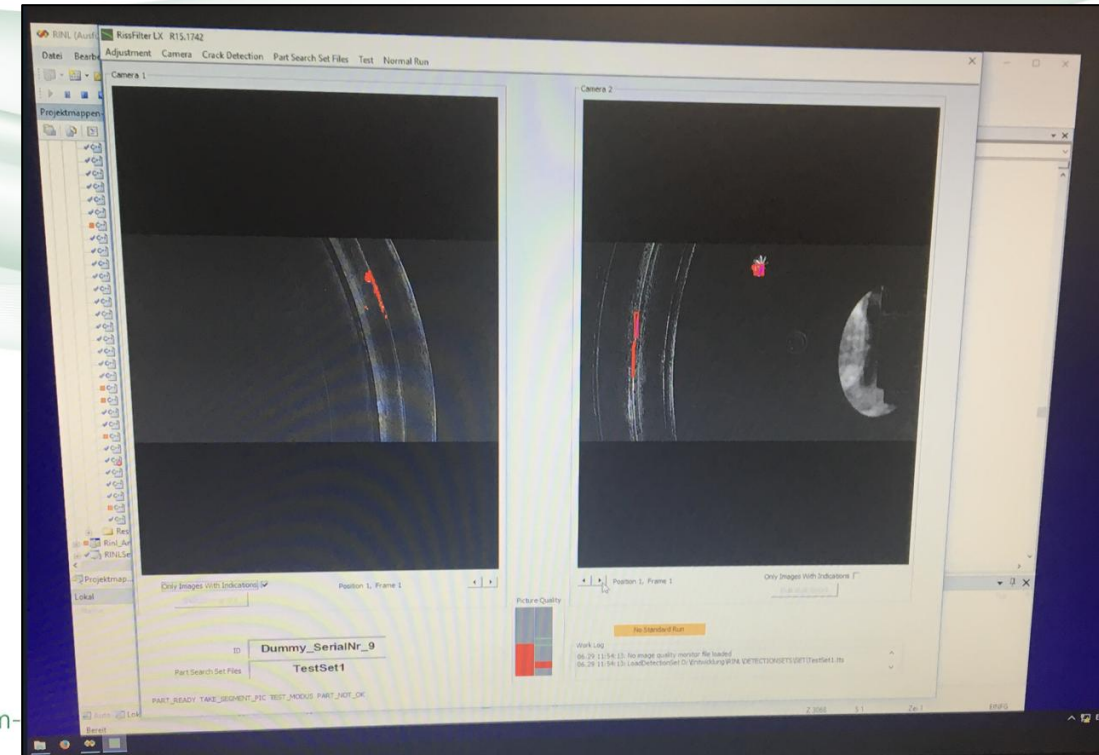
Automatic Defect Recognition



In the last years CGM has developed different software solutions for the Automatic Defect Recognition

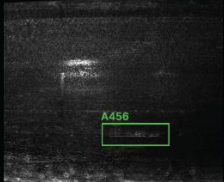
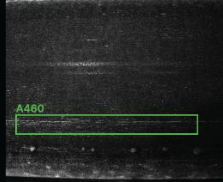
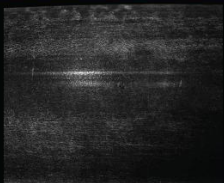
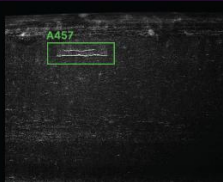
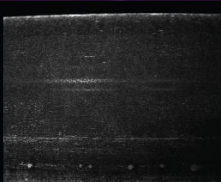
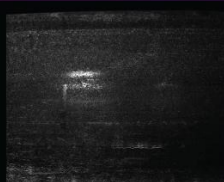
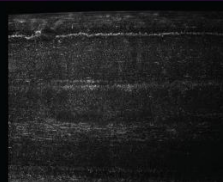
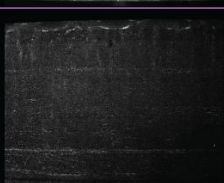
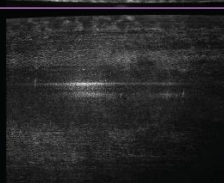
STEP N.1 → Supporting software to help the operator during the Remote Inspection

- The software gives an alarm when an indication is found
- The Operator checks on monitor if the indication is a real defects or not





Accettata Modifica

	Frame F234 Quota 300 mm	Frame F235 Quota 400 mm	Frame F236 Quota 500 mm	Frame F237 Quota 600 mm	Frame F238 Quota 700 mm	
Lato A						Lato A
Lato B						Lato B
Lato C						Lato C
Lato D						Lato D
	Frame F234 Quota 300 mm	Frame F235 Quota 400 mm	Frame F236 Quota 500 mm	Frame F237 Quota 600 mm	Frame F238 Quota 700 mm	



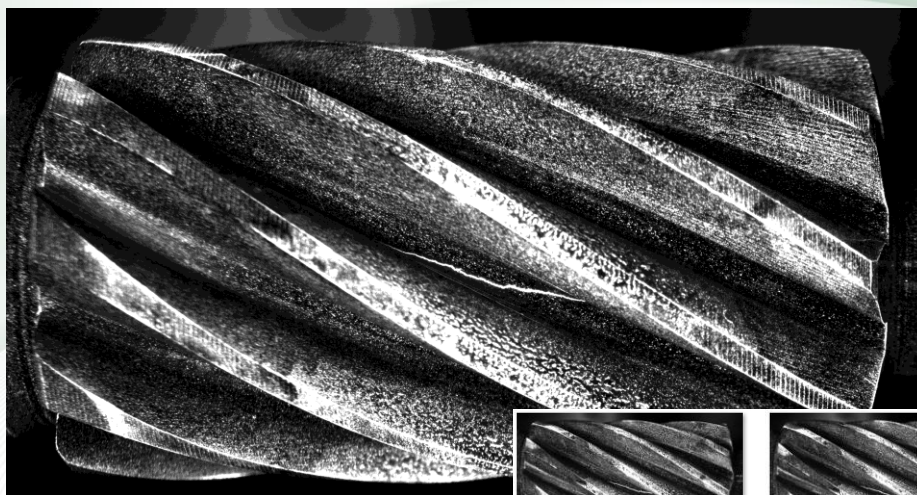
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Automatic Defect Recognition



STEP N.2 → Auto-learning software (Artificial Intelligence) to fully automate the process.

- Artificial intelligent based system, able to continuously learn from new example
- Reduce false indications thanks to high robustness of the software against impurities and reflection
- Traceability of the inspection with data storage
- Fast processing speed → high system productivity



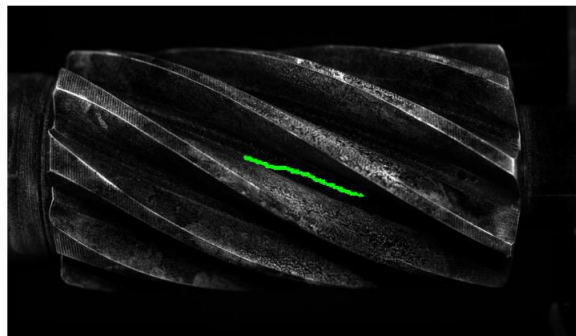


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Automatic Defect Recognition



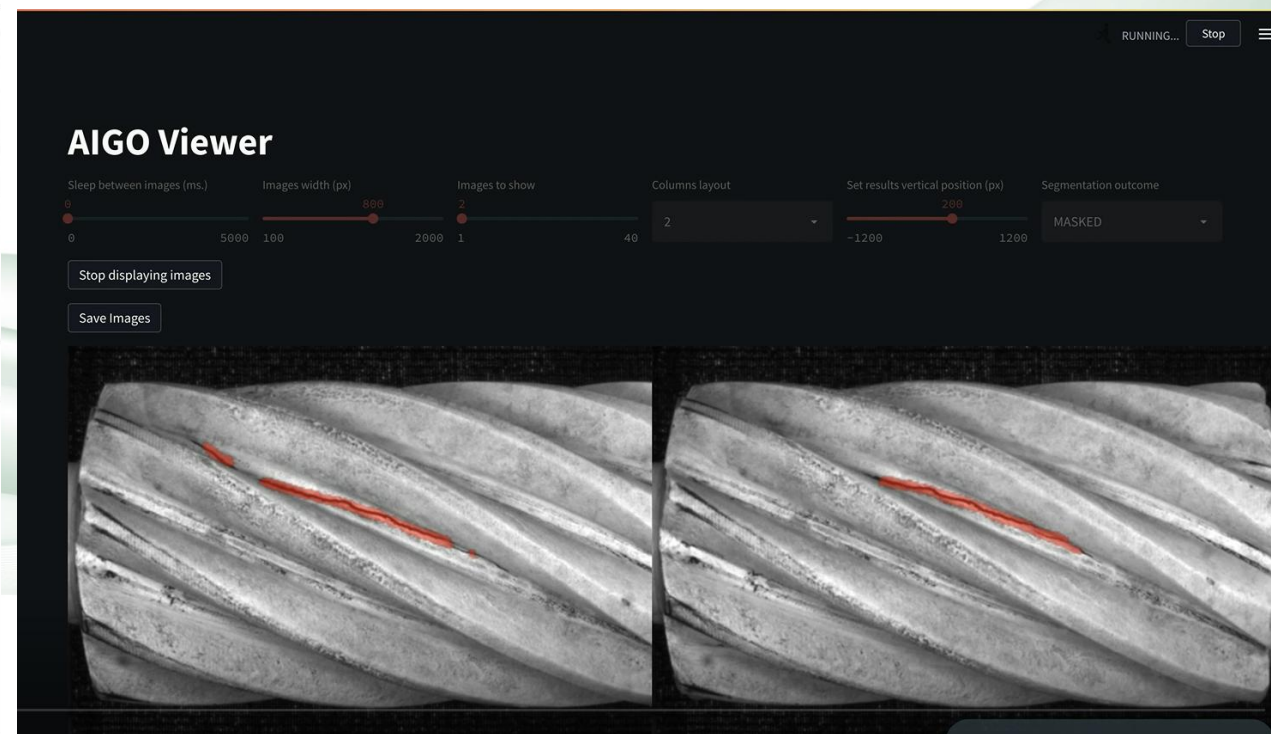
Image_2022-02-18_14-52-45.png - Dice score: 0.77
Input Prediction



Real Mask



Prediction





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Automatic Defect Recognition



Auto-learning function

How to start to use the software: it is necessary to give a starting base to the software to let it start working.

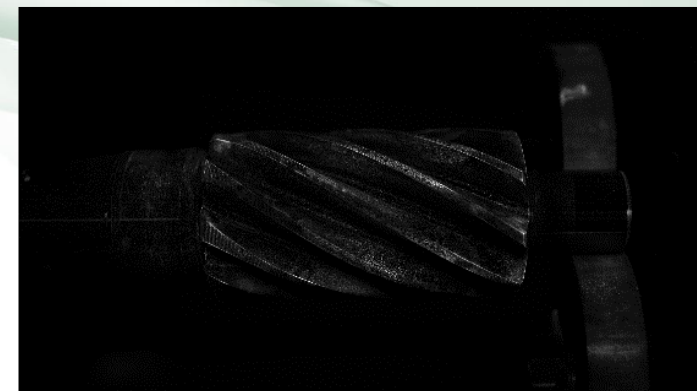
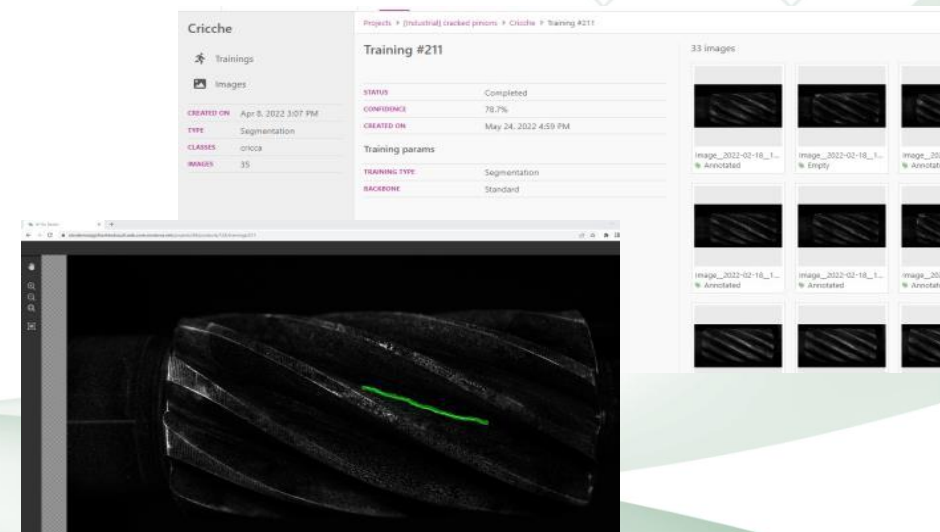
Best alternative

- **Database of images with real defects**

Approaching a new MT system, a database of images with real defects is not often available, so:

Second alternative

- **Database of defect free images:**
 - the software will recognize any indication excluding reflection, impurities and what has been indicated as false indication on the defect free images database
 - The operator has to assist the software in an initial phase selecting which indications are real defects and which are not





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Thank you for your attention



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Controlli Non Distruttivi - Non Destructive Testing



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