ALDAKIN

IDEKO

MEMBER OF BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

3DMC 3D METROLOGY CONFERENCE

Ibai Inziarte

Aldakin

Safe, precise, and cost-effective robot for machinning

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- Introduction about Aldakin
- Robotic machinning cells
- What we have done in collaboration with IDEKO to increase the accuracy in the robots

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01

Aldakin is a group of small companies with 35 years of experience in the integration of electrical-automation-robotics projects in the industrial sector.

02

All the companies are in the north of Spain

03

Different business units: automation and robotics, electrical cabinets, installation and maintenance (mainly electrical)

04

The growth since 2020 has been very significant, from 130 people and a turnover of around 10 million to 220 people and around 17-18 million.

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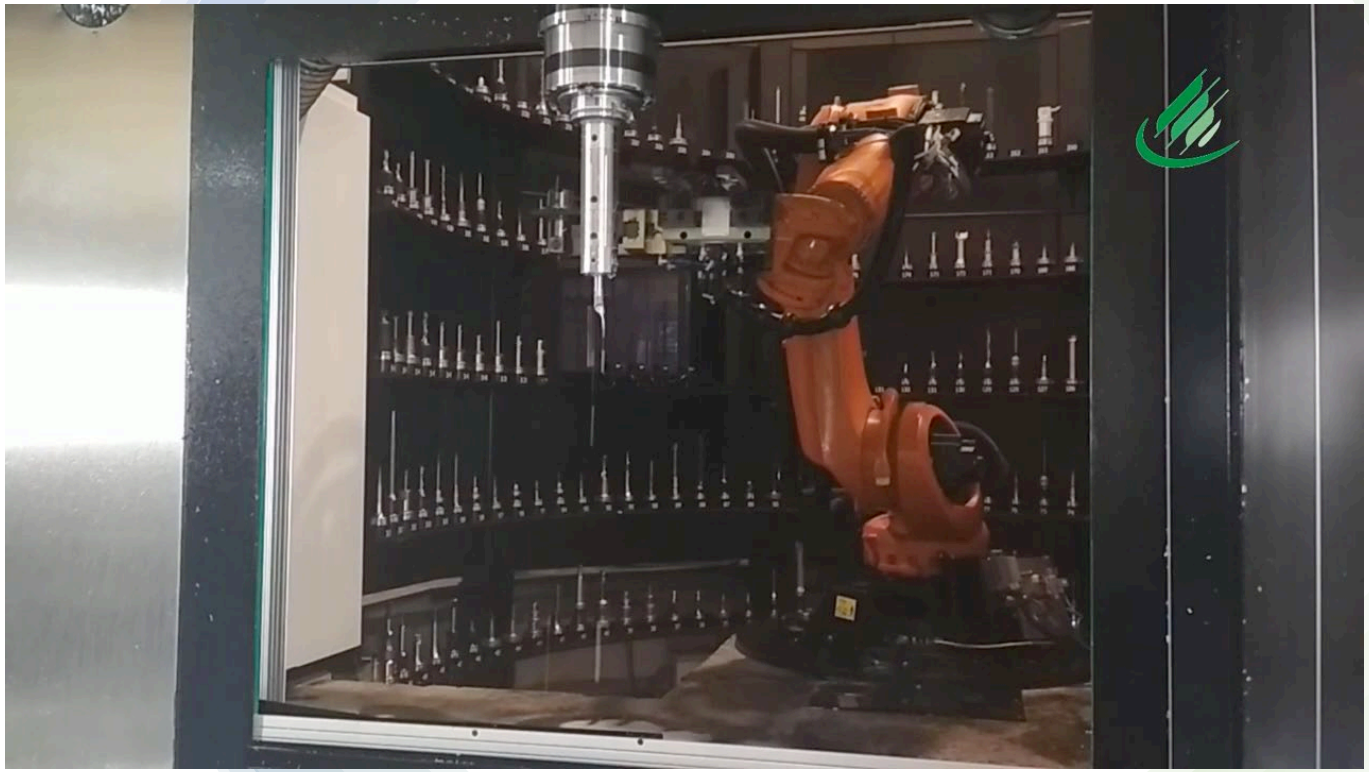
- Aldakin used to make robotic manipulation applications with which it obtained very few results.
- Aldakin, in 2016 began a process of specialisation in robotics towards applications complementary to machine tools.
- This decision was taken due to the great importance of the sector here.



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- The next step was to tackle applications such as the deburring of large metal parts.
- This was all a bit unconscious as we came from the world of robotics and were entering a completely new field.
- During the manufacturing of this type of applications we realised the precision problems we could have due to the low stiffness of the robots.

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Robotic machinning of composites

Current machining machines do not offer the necessary flexibility or the required precision.Line retrofitting costs are unaffordable.

The machining of composite materials produces as a by-product a dust whose prolonged inhalation is harmful to health, causing serious diseases of the lungs, liver, kidneys, eyes and skin, among others

Main objectives of the proposed solution

Composite machining robot with the following features:

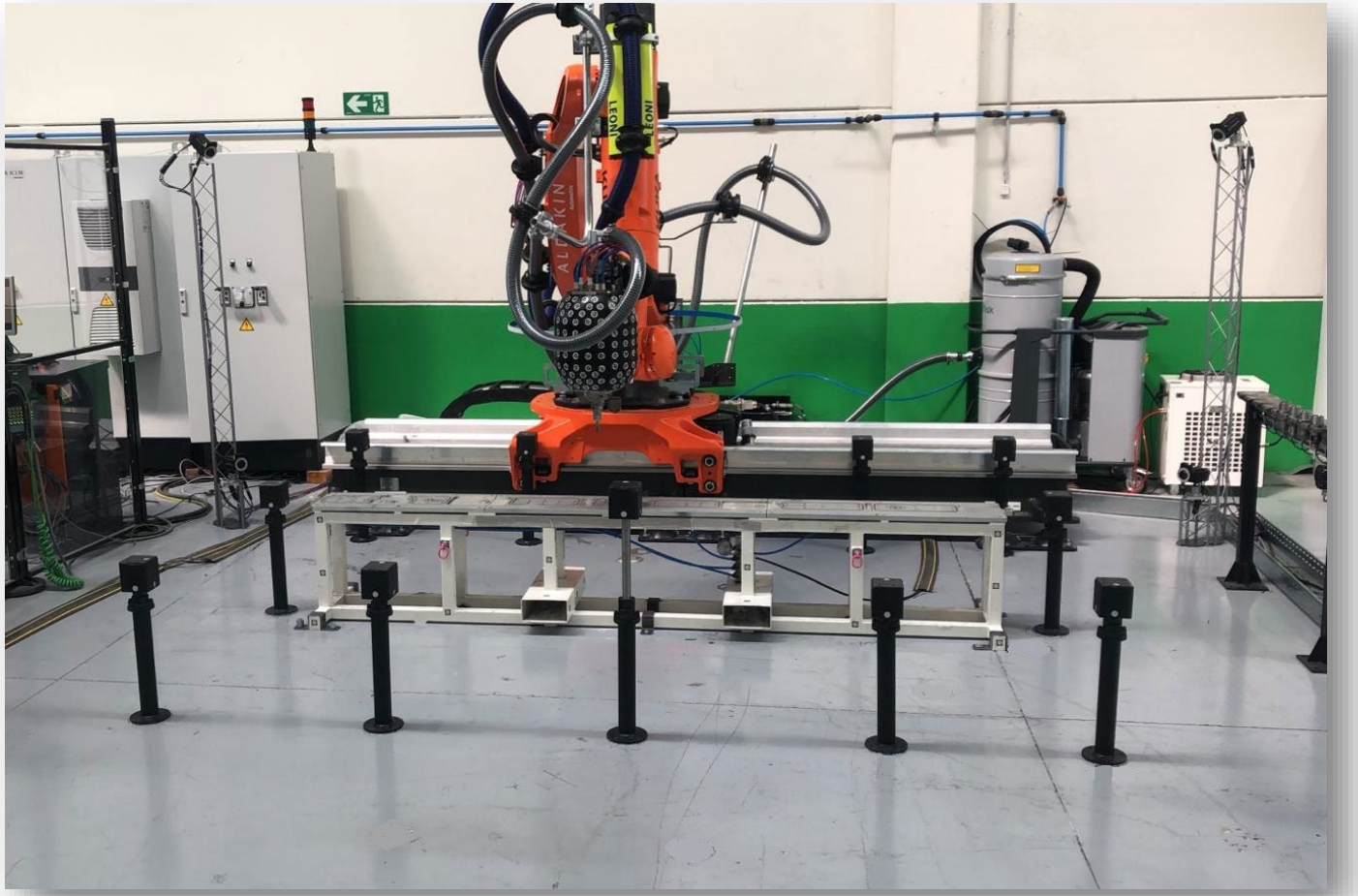
Dust and chip suction from inside tool and spindle.

Accuracy improvement: Between 0.1 and 0.2 mm in the whole volume.

Automatic detection and suppression of chatter vibrations.Robot and process data monitoring in the cloud.

Result of the project:

- Robotic machining center.
- Robot: 300 kg, 2700 mm reach.
- Linear axis for increased reach.
- Spindle 12 kW, 22,000 rpm.
- Siemens 840D CNC control.
- Automatic tool holder changer.
- **Precision magnification with photogrammetry system.**
- On-board vibration and sound sensors

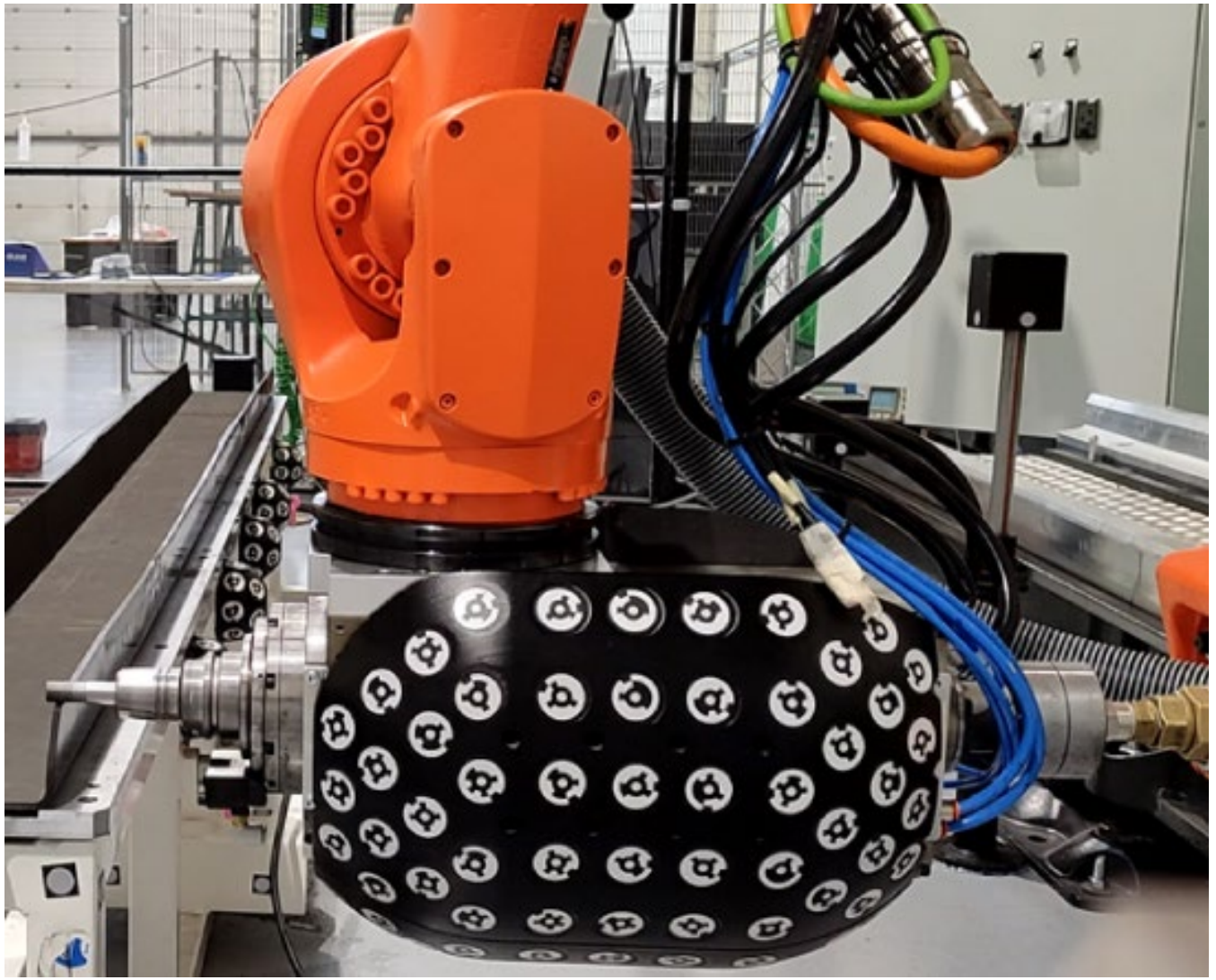


Validation:

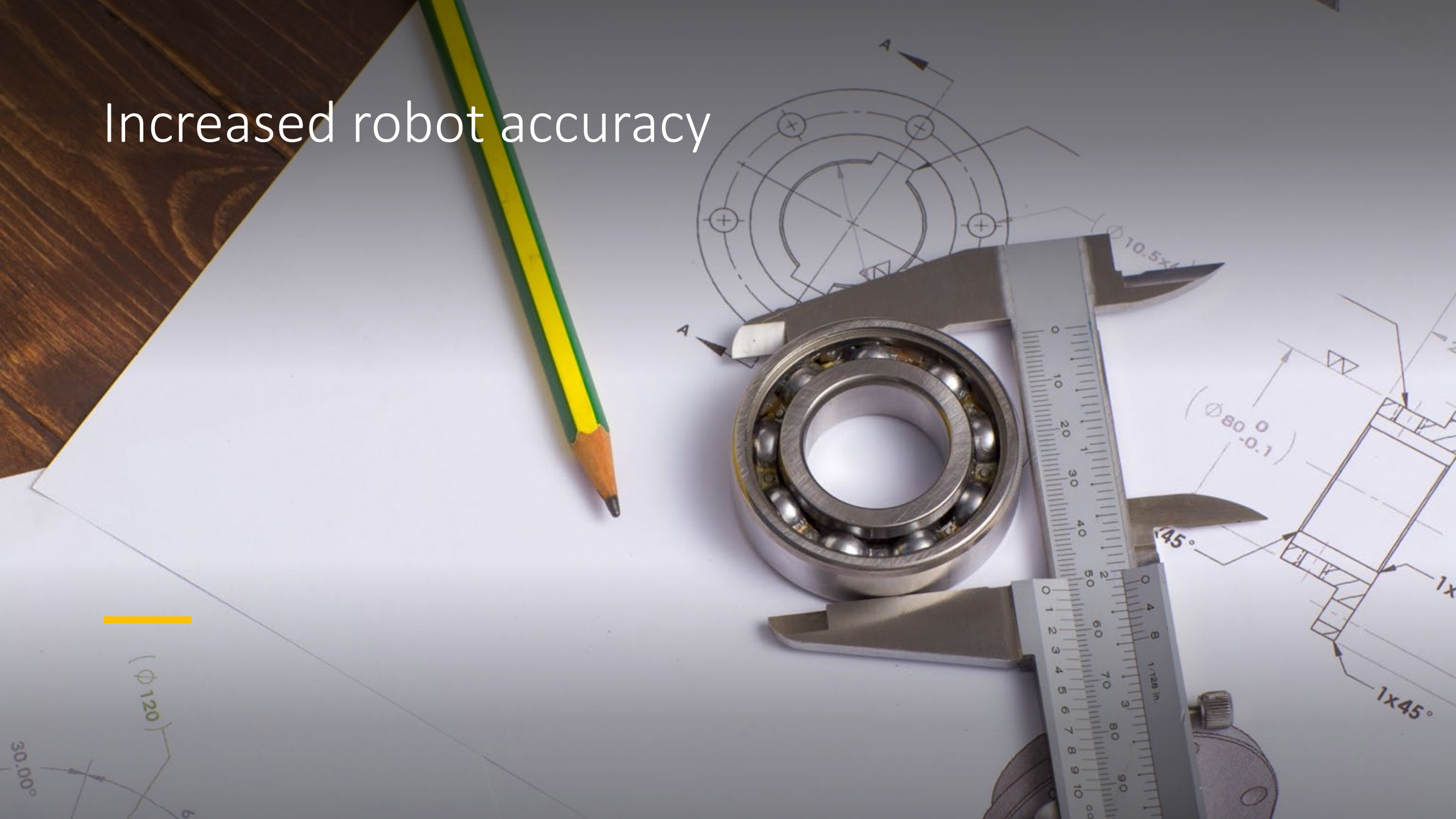
Machining of CFRP and GFRP.

Accuracy verification by external metrology.

Aspiration verification by airborne particulate measurement.



Increased robot accuracy



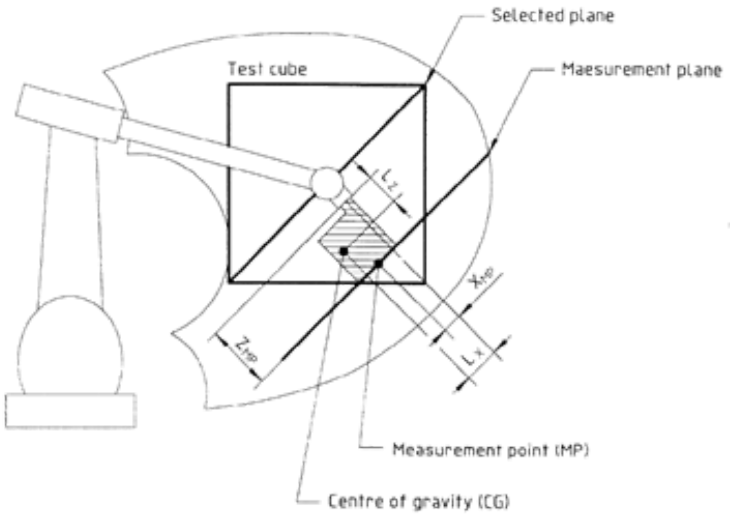
Increased robot accuracy

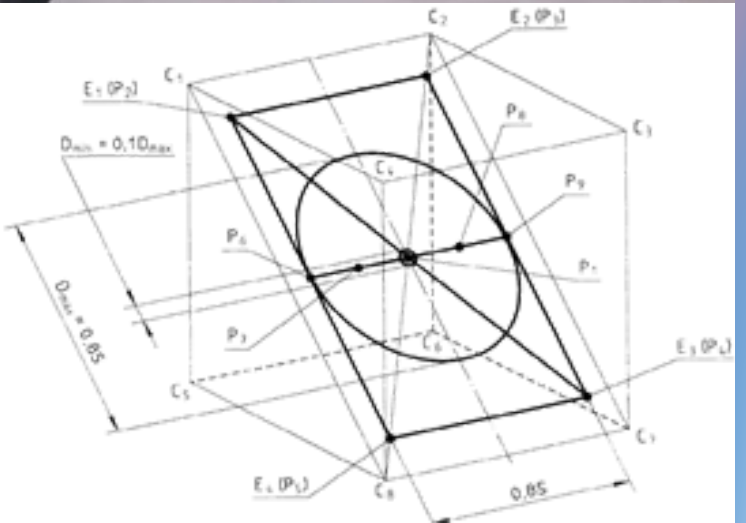
Objective:

- Robot TCP accuracy between 0.1 and 0.2 mm.

Background:

- IDEKO photogrammetric system for alignment of large parts on milling machines.



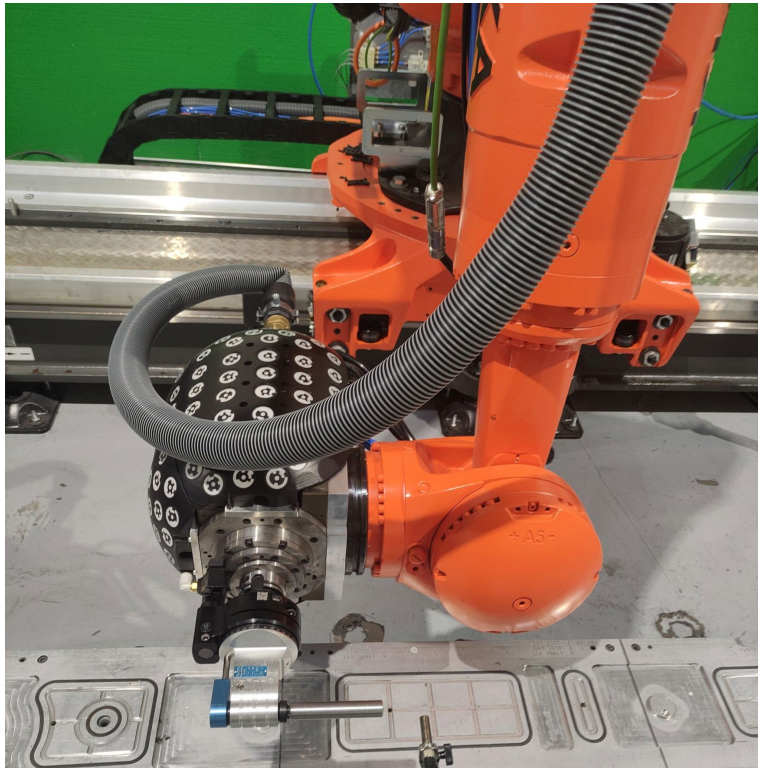


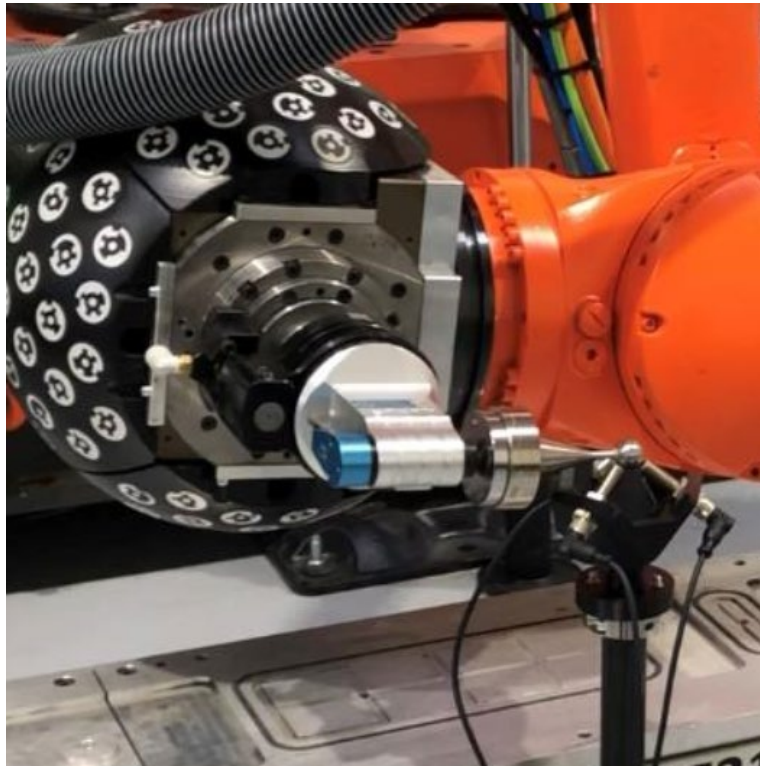
Increased robot accuracy

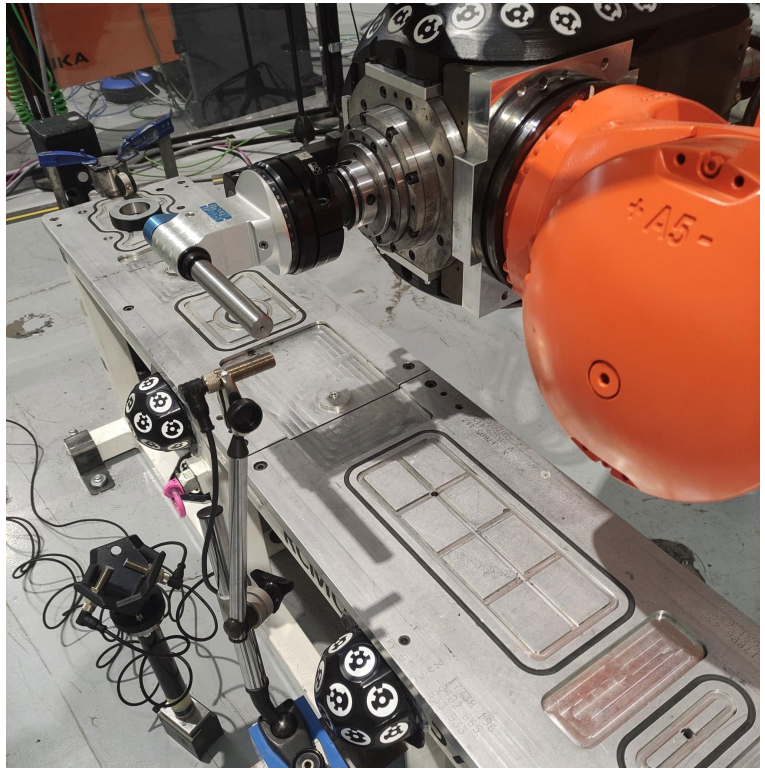
- Continuous measurement of head position by cameras.
- Artificial infra-red reflective markers on the head.
- Very low cost of markers -> Multiple markers reduce chances of losing line of sight.

Increased robot accuracy

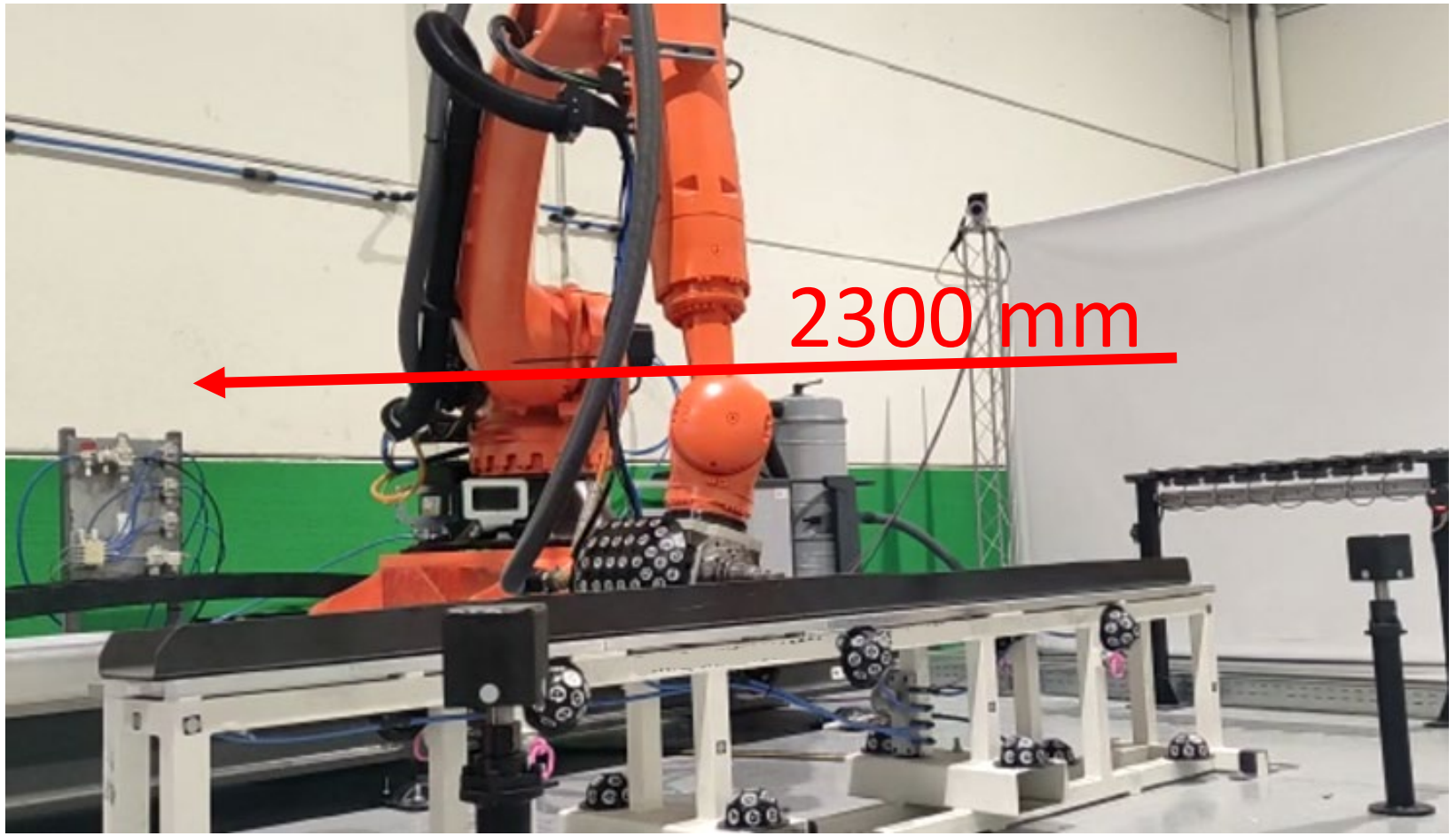
- **Calibration of angled tool holders with vision and inductive sensors.**





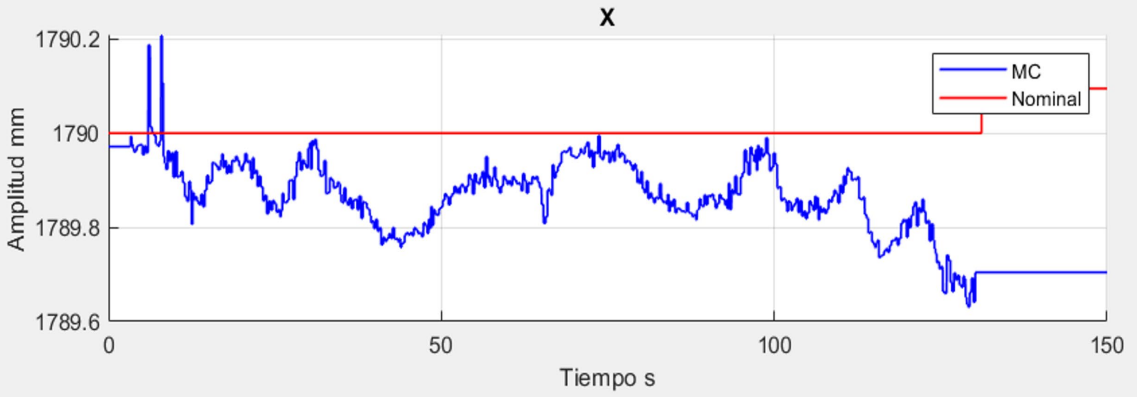


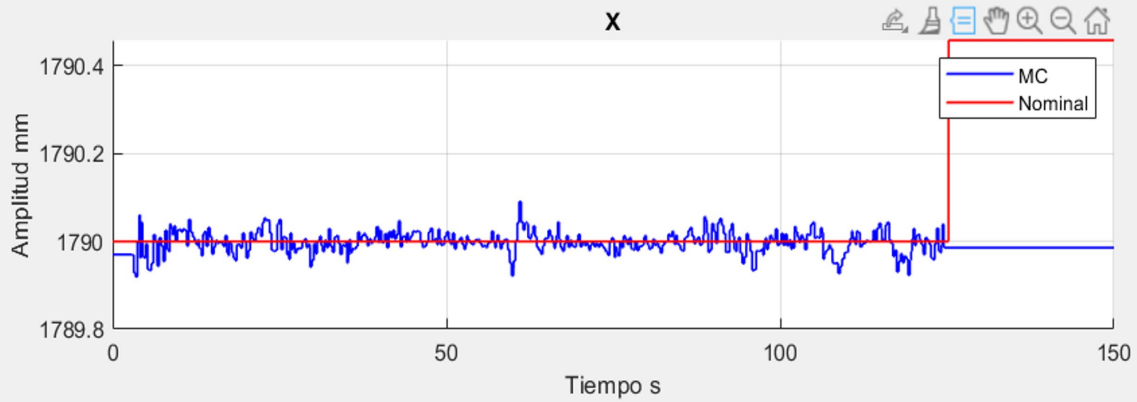
Position measurement of the robot moving along the Y-axis, without and with multi-camera system.

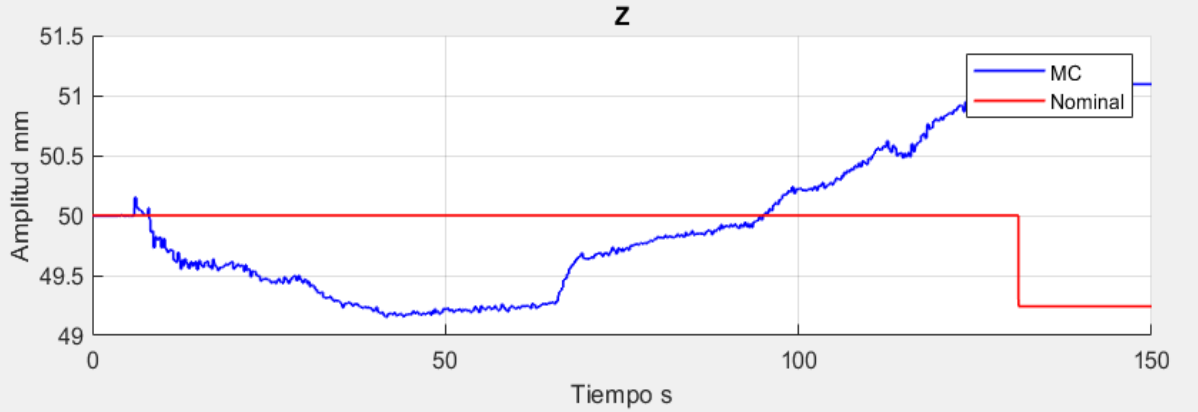


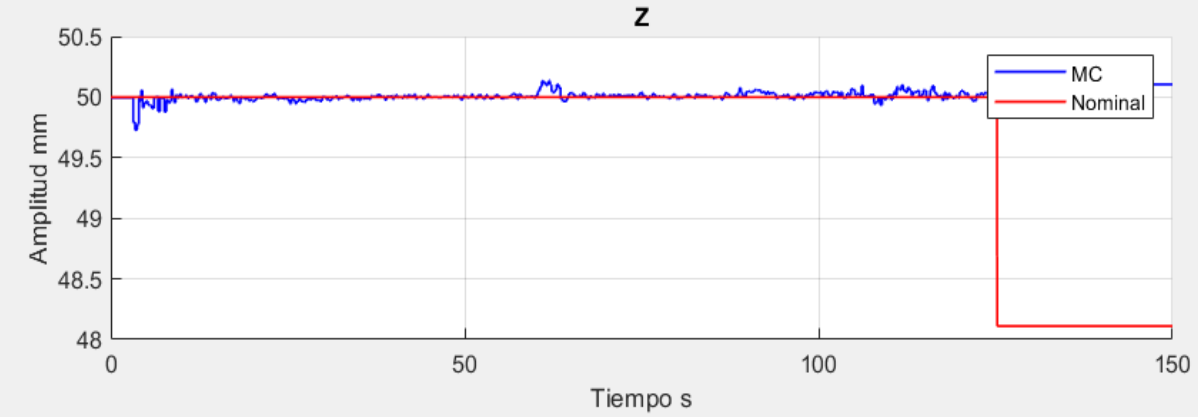
Increased robot accuracy

Position measurement of the robot moving along the Y-axis, without and with multi-camera system.







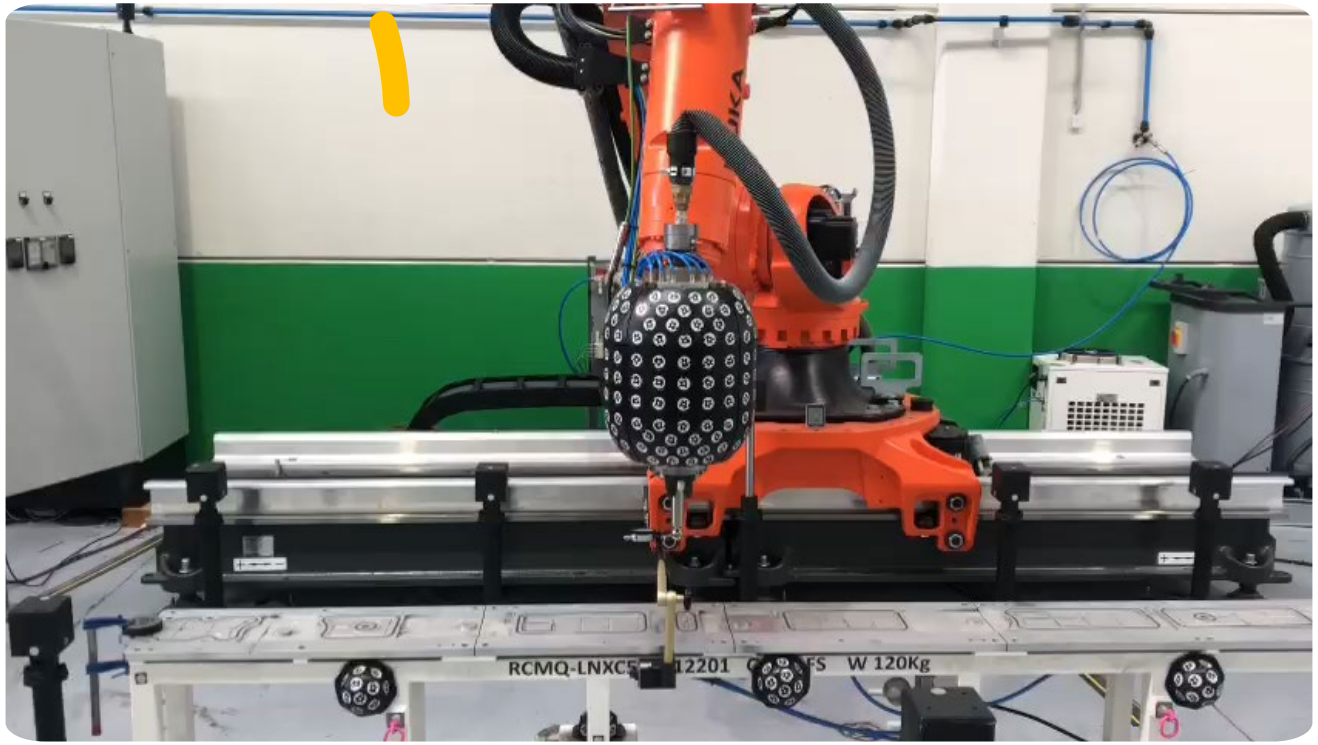


No MC: 2 mm error

With MC: 0,2 mm error

Increased robot accuracy

- Pivoting around a point.
- 40 degrees of pivoting around the X axis of the robot.
- Measurement with 3 orthogonal inductive sensors.
- 30 mm diameter spherical tool.
- With and without multi-camera system.



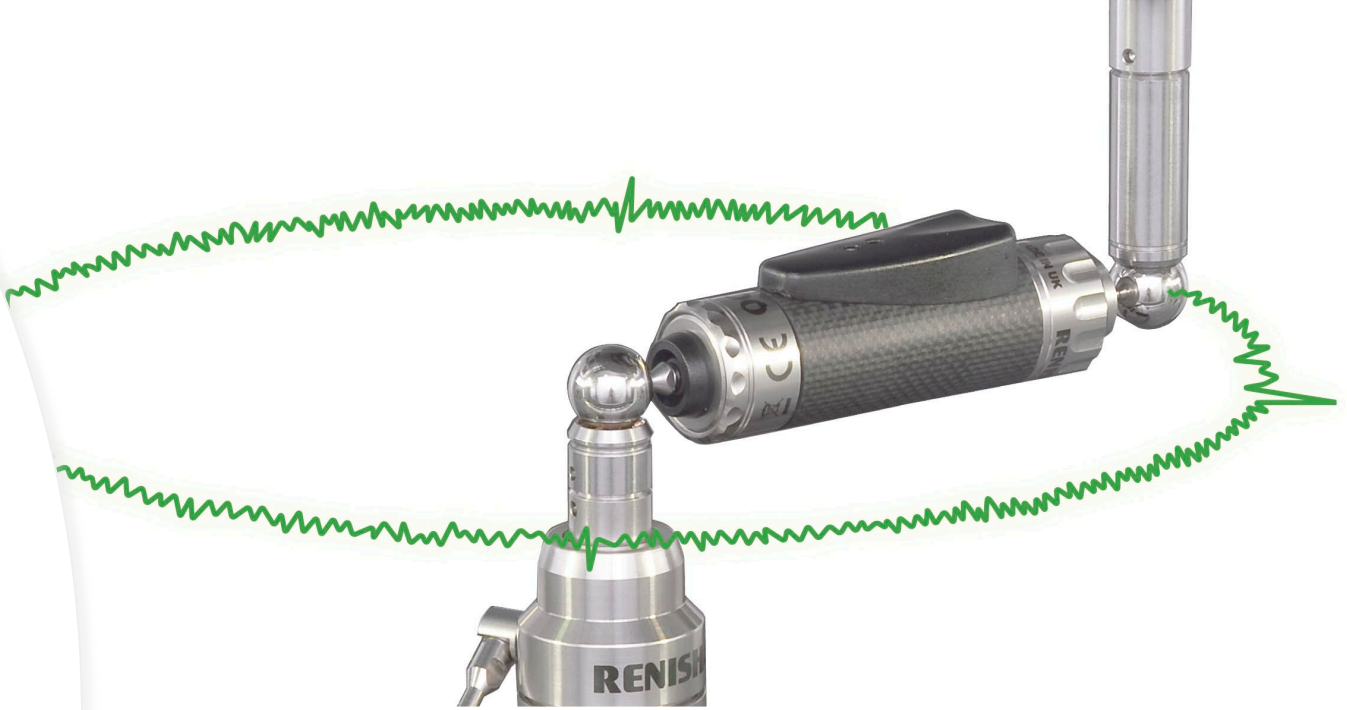
Results

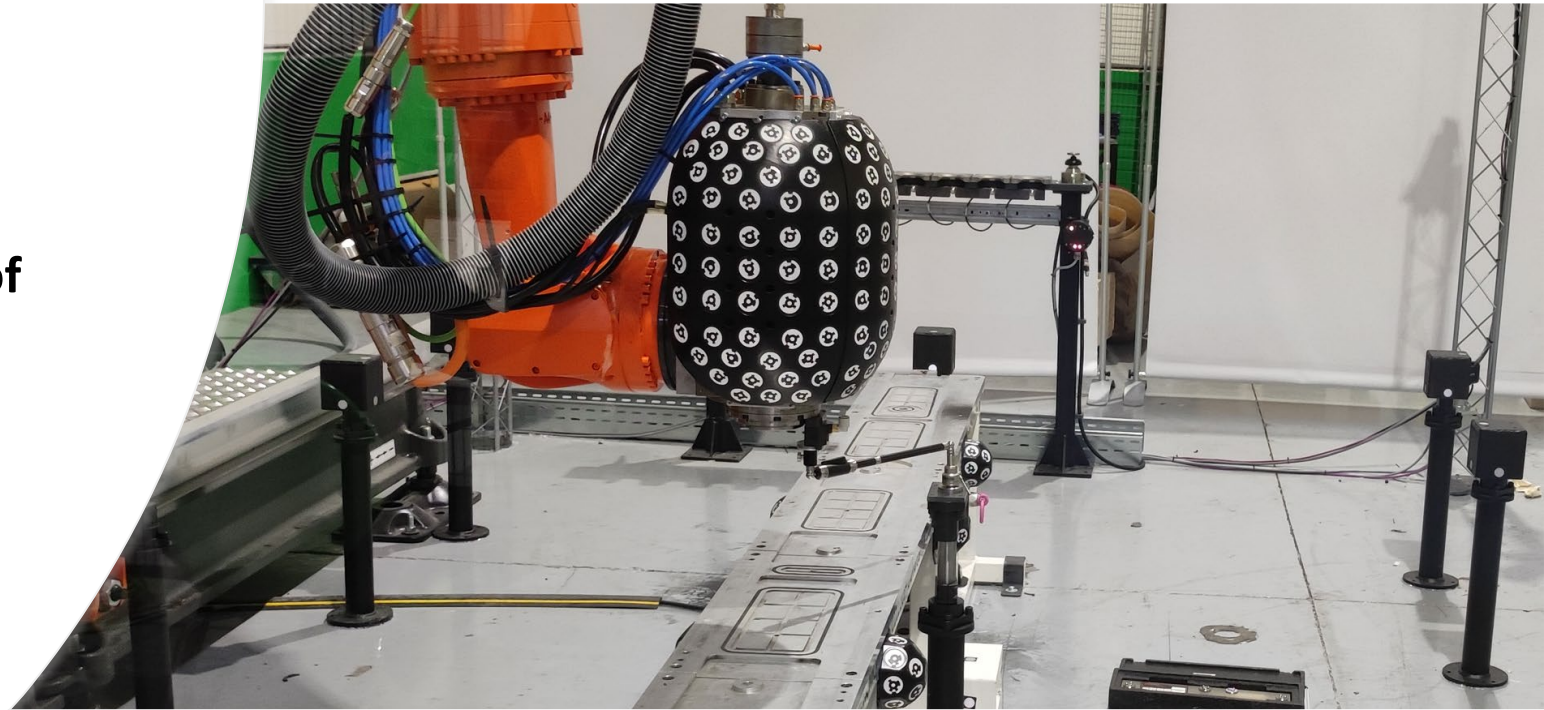
- Without MC: 951 microns
- With MC: 69 microns

Note: Error value in module considering 3 directions X,Y,Z, considering starting point and end point of pivoting, average values of 3 tests.

Increased robot accuracy

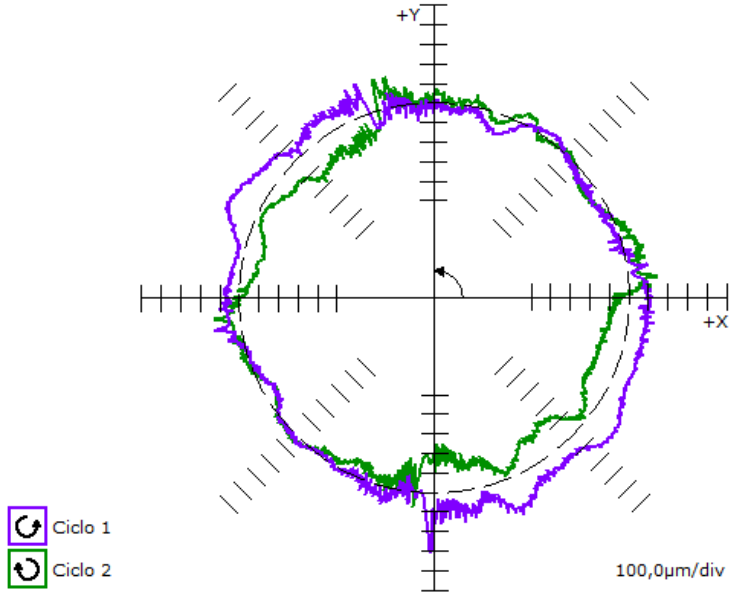
- **Renishaw ballbar**
  - **Test data:**
  - **150 mm and 300 mm radius.**
  - **Feed rate: 1000 mm/min**
  - **XY plane of the robot.**
  - **Head aligning its axis with the Z axis of the robot.**
  - **Ballbar calibrated with zerodur**





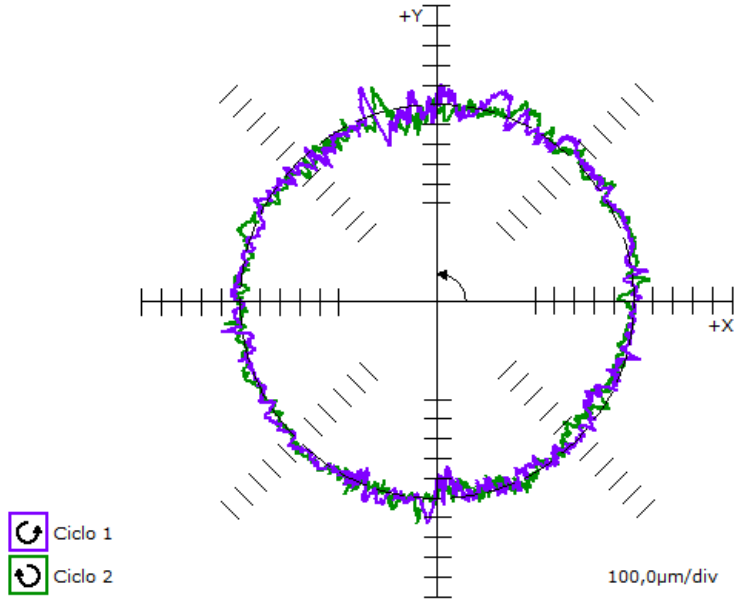
Increased robot accuracy

300 mm radius, without multi-camera



Positioning tolerance: 1735,7 microns
Better radius: 300,273 mms
Circularity: 557,5 microns

300 mm radius, with multi-camera



Positioning tolerance: 370,6 microns
Better radius: 299,954 mms
Circularity: 329,7 microns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Many thanks to the audience and to IDEKO for the invitation, specially:

Pablo Puerto
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i.inziarte@aldathink.com