OPTICAL 3D MEASURING SYSTEMS
- Dimensional traceability for industrial and medical applications

Bruno Gastaldi
INTI
MOTIVATION OF THE PROJECT

The role of metrology is changing: *final inspection is becoming less important*
MOTIVATION OF THE PROJECT

The change from measurement as a quality control tool to a fully integrated step in the production process
MOTIVATION OF THE PROJECT

The industrial manufacturing processes are changing: 3D printing / adaptive manufacturing technologies
MOTIVATION OF THE PROJECT

*Measuring systems are now able to measure and adapt its measurement process in real-time*

*Note: Images from GOM Web page*
MOTIVATION OF THE PROJECT

*Increasing use of optical 3D metrology in multiple applications:*

- Automotive industry
- Aerospace industry
- Medical Research
- Power Generation
PREVIOUS COLLABORATIONS

Cenam, Inmetro, Inacal and Inti were members of the project “IADB SIM Research Engagement Opportunity”

Project: Calibration of standard reference material for use in calibrating the magnification or scale of optical microscopy and scanning electron microscopy.
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NMIs Participants:

- Cenam (Mexico)
- Inmetro (Brasil)
- Ibmetro (Bolivia)
- Dictuc (Chile)
- Inti (Argentina)
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NMIs precondition

Experience in traditional metrology: contact metrology

Relationship with companies that use optical 3D metrology

The NMIs does not have 3D optical measurement equipment
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The general objective:

Study of optical 3D measuring systems

Key objectives:

1- Study of traceability and the standards or guidelines used
2- Patterns required for performance evaluation according to standards or guidelines
3- Study of typical sources of errors
4- Working groups with companies that use optical 3D metrology
5 - Development of special patterns for specific applications
OPTICAL 3D MEASURING SYSTEMS PROJECT

Key objective 1: study of traceability and the standards or guidelines used

Procedures of 3D optical measuring systems according to the existing guidelines:

VDI/VDE 2634: Part 1 for point by point probing / Part 2 for optical systems based on area scanning / Part 3 for multiple view systems based on area scanning
OPTICAL 3D MEASURING SYSTEMS PROJECT

Key objective 1: study of traceability and the standards or guidelines used

Procedures of 3D optical measuring systems according to the existing guidelines:

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*Key objective 2:* artifacts required for performance evaluation according to the standards or guidelines
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Key objective 3: study of typical sources of errors

Manufacturer artifact calibration
3D instrument adjustment with the artifact provided by the manufacturer
Ambient light
Target reflectivity
Instrument orientations

Note: Images from Performance evaluation of a portable 3D imaging system publication from NRC
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Key objective 4: working groups with companies that use optical 3D metrology
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*Key objective 5*: development of special artifacts for specific applications

Notes:
(a) NPL freeform artifact  (b) Image from EMRP JRP IND62 –TIM: Use of on-board metrology systems for area-scanning on machine tools  (c) Image from Artefact for optical surface measurement publication from NRC
## OPTICAL 3D MEASURING SYSTEMS PROJECT

### Time schedule

<table>
<thead>
<tr>
<th>Activity / Deliverable</th>
<th>2022</th>
<th>2023</th>
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<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Feb</td>
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<tr>
<td><strong>Kickoff:</strong></td>
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<tr>
<td>Uploading brief description of equipment and infrastructure</td>
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<td>related to the project from each institute. Start of</td>
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<td>technical communication and exchange via internet.</td>
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<td><strong>Development of the research project:</strong></td>
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<tr>
<td>Develop performance evaluation procedures of 3D optical</td>
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<td>measuring systems according to the existing guidelines,</td>
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<td>VDI/VDE 2634.</td>
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<td>Purchase of required standards / acquisitions of patterns</td>
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<td>for pilot study.</td>
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<td><strong>First Meeting at one of the NMIs</strong></td>
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<td><strong>Minutes of the Meeting</strong></td>
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<td><strong>Development of the research project:</strong></td>
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<tr>
<td>Study of sources of errors in industrial and medical</td>
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<td>applications / Working groups with companies / Development</td>
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<td>of special patterns.</td>
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<td><strong>Budget requirements:</strong></td>
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<td>Adquisitions of patterns for pilot study / Pattern</td>
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<td>circulation between NMIs.</td>
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<td><strong>Final Meeting at one of the NMIs</strong></td>
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<td><strong>Minutes of the Meeting</strong></td>
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<td><strong>Final draft of international publication.</strong></td>
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<td><strong>Final Report submission</strong></td>
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<td>**Distribution of all deliverables to SIM members via</td>
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<td>internet.</td>
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Questions with the aim to strengthen the R&D project

1- Do you know if the optical 3D technology traceability chain is adequate?
(Manufacturer / NMI / Accredited laboratory)

2- What do you consider to be more relevant?
   - Development of procedures in accordance with existing guidelines
   - Development of special patterns for specific applications
¡THANKS!

!MUCHAS GRACIAS!