

EURAMET Project 'Report'



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1	Report <input type="checkbox"/> progress report <input checked="" type="checkbox"/> final report	2	Reference No: 866
3	Subject Field L - Length		
4	Type of collaboration Cooperation in Research		
4A	In the case of a comparison Registered as Key comparison (KC) or Supplementary Comparison (SC) in the KCDB: <input checked="" type="checkbox"/> no <input type="checkbox"/> yes If yes: No. of KC/SC:		
5	Coordinator Institute/Country: INRIM /Italy Name: Gian Bartolo Picotto Phone: +39 0113919969 E-mail: g.picotto@inrim.it		
6	Participating Partners 6A EURAMET members or associates (Institute's standard acronym with country code in brackets) as registered on EURAMET website. BEV (AT), CEM (ES), CMI (CZ), DFM (DK), INRIM (IT), LNE (FR), METAS (CH), SMD (BE), SMU (SK), UME (TR), VTT-MIKES (FI) 6B Institutes not being EURAMET members or associates (Institute's full name and country in brackets) NMISA (SA) 6C Change of projects partners: (Please indicate here changes of project partners compared to the previous report) New project partners Removed project partners		
7	Title of project Interferometric calibration of microdisplacement actuators		
8	Progress/Final Eleven laboratories from EURAMET and one laboratory from AFRIMETs participated in this "Co-operation in Research" project as a pilot study on interferometric calibration of microdisplacement actuators. Measurements reports have been submitted by all the laboratories. Measurements have been performed with homodyne and heterodyne interferometers, various optical and mechanical set-ups, and different orientations (horizontal, vertical up and vertical down) of the actuator. Compensation of the optical non-linearity made mostly use of own methods and associated software tools. Traceable instruments were used to measure temperature and ambient air parameters for air refractivity correction. Some deviation of full range displacements occurred for a certain period covering the measurements by three labs and one by the pilot. It has no longer been observed with calibration measurements repeated by the pilot after about one year. A compensation for has not been		

introduced. The observed deviation is noticed in the results of these labs, likely with a contribution to the uncertainty of the artefact. Other contributions from hysteresis, drift and bending of the connecting cable have been considered, as well.

The overall reported results, corresponding to displacements vs. driving voltage of the actuator, have been analyzed either by weighted mean and simple mean approaches. The analysis makes use of a calculus sheet early proposed and contributed by partners. The En values are determined with reference to the positions calculated by the coefficients of a common third order polynomial with full scale displacements, and by a common average slope with short range displacements. The En values of displacements up to $\pm 5 \mu\text{m}$ show some inconsistency of results with possible outliers, and some spread of results, thus requiring future steps to better highlight, quantify and compensate for errors not yet well identified or underestimated. Nevertheless, it is worth noting En values together with the ratio between the deviation of individual positions from the reference value and the associated uncertainty of the difference, ratio within 1 for most of the laboratories.

Meanwhile, a generally good consistency is obtained with short range displacements within $\pm 100 \text{ nm}$, as demonstrated by the En values (< 1) of all reported positions/labs, and by the ratio well within 1 between the deviation of individual positions from the reference value and the associated uncertainty of the difference.

Some spread of results has been observed with the unwanted rotations (yaw and pitch) of the actuator driven up to the full range displacements. Changes of the maximum pitch and yaw by re-orienting or by turning the actuator have been reported by some partners, whereas significant changes have not been observed by other partners.

9	In the case of a KC/SC comparison & final report	<input checked="" type="checkbox"/> no <input type="checkbox"/> yes
	Final report sent to the appropriate CC WG	
	Report endorsed by the CC WG	<input checked="" type="checkbox"/> no <input type="checkbox"/> yes
10	Expected completion date	11
	2018-02-28	Date
		2018-10-10

Notes for completion of the form overleaf

NOTES FOR THE COMPLETION OF THE FORM (numbers refer to boxes overleaf)

Forms are to be sent to the EURAMET Secretariat (secretariat@euramet.org) as word or pdf file

- by the TC Chair or
- by the proposer/coordinator of the project with copy to the TC Chair.

If the proposer/coordinator is not EURAMET TC contact person the national contact person(s) of the relevant TC(s) have to be involved in the registration process.

- 2 **Ref No:** The project reference number which has been assigned by the EURAMET Secretariat and on which progress is reported; you can find it on the EURAMET website.
- 3 **Subject Field:** The field specified in the EURAMET Project Form.
- 4 **Type of collaboration:** The field specified in the EURAMET Project Form.
- 4A **In the case of a comparison:**
- In the case of a KC or a SC to be registered in the KCDB, the coordinator should be aware that the protocol should be sent to the appropriate CC WG for approval (KC) or for feedback (SC).
 - In the case of a KC, the comparison can take place only if its protocol has been approved by the appropriate CC Working Group.
 - The KC must be compatible and linkable to the parent CC comparison.
- 5 **Coordinator:** The Coordinator is the person who is appointed as the contact point for the project detailed overleaf.
- 6A/6B **EURAMET members or associates / Institutes not being EURAMET members or associates:**
Please indicate here the current list of all collaboration partners. Newly assigned or removed partners should additionally be listed under 5C
- 6C **Change of projects partners:** Please indicate here the project partners which have changed since the project has been proposed or agreed or since the last reporting.
- 7 **Title:** The title given in the EURAMET Project Form.
- 8 **Progress:** A brief description of the progress should be entered in the space provided. Comments on the advantages of undertaking the work collaboratively through EURAMET would be useful. Completion of this Report is not deemed as publication of the work. Collaborators are encouraged to publish their work through normal channels, mentioning it was undertaken as EURAMET collaboration.
- 9 **Expected completion date:** If the progress of a project is being reported on this form then an estimate of the completion date should be made. If the project has now been completed then the actual date of completion should be given.
- 10 **Date** of transmission to EURAMET Secretariat.