

BIPM Capacity Building & Knowledge Transfer Programme

2019 BIPM - TÜBİTAK UME Project Placement

FINAL REPORT

Project Name	Improvement and knowledge transfer in length and dimensional metrology
Description	In order to gain better theoretical knowledge and practical skills, the candidate expected to learn from experts within TÜBİTAK UME especially in long distance measurement, calibration of line standards, and surface texture and form measurements as well as uncertainties of measurements on related topics
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Date	1 March 2019 – 29 March 2019

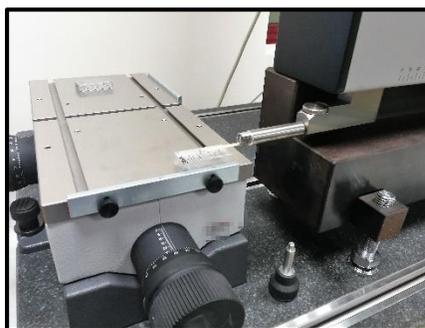
Motivation & Introduction

NMIM is planning to have its own facilities for long range measurement to cater the demand from industry. In order to establish the necessary facilities, experienced technical personnel is needed to manage all the requirements before and after this project. Since TÜBİTAK UME has established these facilities, I found that "BIPM - TÜBİTAK UME project placements" presented a great opportunity to obtain the required knowledge and experience. Other than that, the main objectives in my work at TÜBİTAK UME was to learn about the calibration of line standards, surface texture and form measurements and their uncertainties of measurement since TÜBİTAK UME is well equipped with facilities and experts in these areas.

Research

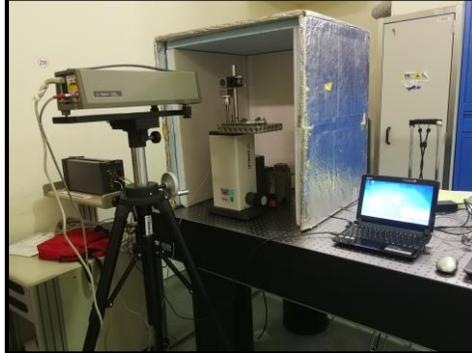
The project was designed to consist of four different measurement topics each covering their theoretical and practical aspects and uncertainty calculation training. The main subjects are briefly discussed below:

1. Roughness measurements
 - (a) Calibration of portable roughness device
Standard used: Roughness specimen and optical flat
 - (b) Calibration of roughness machine
Standard used: Roughness standard and roughness machine



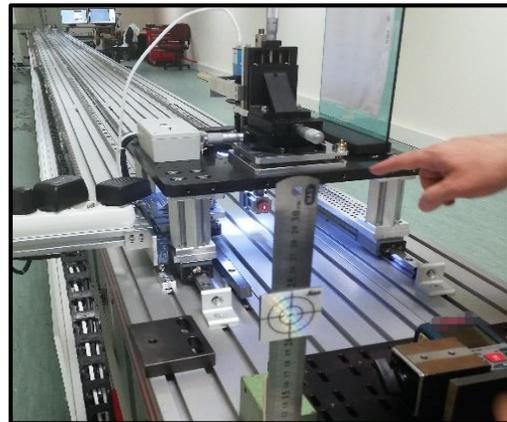
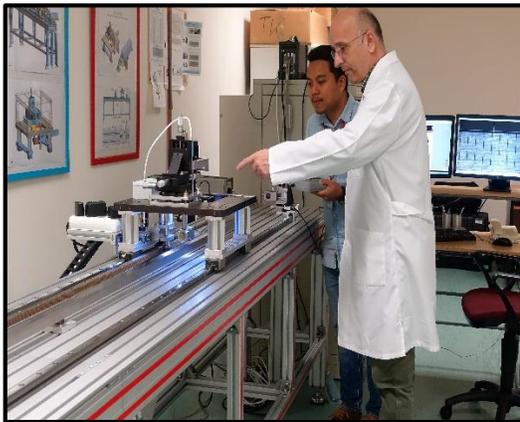
For calibration of surface texture, I studied all related calibration procedures, document standards, best practices and parameters involved in roughness measurements. I also managed to produce error calculations and uncertainty budgets for both measurements mentioned above.

2. Precise line standard measurement
 - (a) Calibration of glass scale
Standard used: Laser interferometer
 - (b) Calibration of dial gauge tester
Standard used: Laser interferometer



For this calibration, I studied the technical skills, best practices during calibration of standards scale and the strategy to obtain good repeatability of measurement as well as the evaluation of measurement uncertainties.

3. Long range measurements
 - (a) Calibration of steel ruler
Standard used: Laser interferometer and long bench system
 - (b) Calibration of electronic distance meter
Standard used: Laser interferometer and long bench system



As mentioned earlier, the length and dimensional laboratory of NMIM is planning to establish long bench facilities to cater to the demand from legal metrology and industries. I have learned all the theoretical requirements, technical designs and specifications for establishment of these facilities. Once established, the calibration of EDMs, long range tapes, steel rulers and other long range measurements can be performed. To these ends, I learned all related calibration procedures, work instructions, document standards, best practice and factors that contribute to uncertainties of measurement.

4. Threaded gauge measurements
 - (a) Calibration of thread ring gauges
Standard used: ring gauge and ULM/CMM
 - (b) Calibration of thread plug gauges
Standard used: gauge block and ULM/CMM



I studied and performed this calibration with ULM and CMM. The method used in this calibration is the two ball method and three wire method. During the training, I studied the theoretical aspects of threaded gauge calibrations, calibration procedures, work instructions, document standards, best practices and factors that contribute to uncertainties of measurement. I also learned about pitch diameter calculations and produced uncertainty calculations for this calibration.

Conclusions and Future Work

In conclusion, all objectives have been achieved during this placement. A series of technical discussion as well as hands on training will be conducted for the benefit of other colleagues at NMIM in order to transfer all the knowledge that I have obtained during this placement. With the knowledge and experience gained, I will involve myself in the project plan for improvement of current capabilities and development of new capabilities at my institute, especially in long range measurements, roughness and form measurements, precise line standard measurements and threaded gauge measurements.

Acknowledgements

I would like to express my sincere gratitude and appreciation to BIPM and TUBITAK UME for giving the opportunity to participate in this beneficial program. Next, a special acknowledgement and appreciation goes to Head of Dimensional Laboratory; Dr. Muharrem ASAR, all of my mentors and supervisors; Dr. Murat AKSULU, Mr. Bülent ÖZGÜR, Mr. Okhan GANIÖĞLU and Mr. İlker MERAL for their times and efforts to train me during this placement at Dimensional Laboratory of TUBITAK UME. Last but not least, special thanks to Mr. Omer Altan, Ms. Hanen Tir and International Relation Department team for being helpful during my stay at Turkey.