

BIPM Capacity Building & Knowledge Transfer Programme

2018 BIPM - TÜBİTAK UME Project Placement

REPORT

Project Name	Improvement of calibration capability of UzNIM mass laboratory
Description	Calibration of mass measuring instruments
Author, NMI	Javokhir Nosirov, UzNIM, Uzbekistan
Mentor at TÜBİTAK UME	Sevda Kaçmaz, Mass laboratory, TUBITAK UME, Turkey
Date	26.02-07.05.19

Motivation & Introduction

The aim of my project is to obtain the necessary knowledge and experience to improve the calibration system at the Uzbek National Metrology Institute (UzNIM) in the field of mass measurement.

The result of the project is the improvement of my existing knowledge, the study of new methods for calibrating mass measuring instruments and the study of new methods for monitoring and analyzing reference and working measuring instruments in mass metrology.

As a result of the project, the Mass Laboratory at UzNIM will enhance its capability to provide reliable metrological traceability from the national standard of mass unit to accredited laboratories and other establishments engaged in mass measurements, carry out self-calibration of its own reference weights of E1 accuracy class and establish a new primary mass standard. Other expected outcomes include increased accuracy in the measurements carried out by independently determining the density and volume of weights of our own reference mass standards and the mass standards of users, establishment of the capability to calibrate dead weights to ensure metrological traceability from the national standard of mass unit to reference and working measuring instruments, and the recording of the history of the national standard of the unit of mass and reference measuring instruments in order to control their metrological characteristics.

Research

The objects of study in my project are weights of accuracy classes E0, E1 and E2, mass comparators, electronic scales and dead weights.

The project was divided into two phases:

- the study of the theory of mass metrology;
- practical measurements based on the theoretical materials studied.

During the implementation of the project, I improved my knowledge in the field of weights calibration of the accuracy class E2 according to C.4.1 OIML R 111-1.

After improving my knowledge of the direct comparison method based on the ABBA weighting cycle, I improved the Excel software for calculating measurement results with extended uncertainty.

To carry out self-calibration of weights of E1 accuracy class and establishment of a new primary mass standard, I studied the subdivision method of calibration according to C.3.2 OIML R 111-1.

In the field of determining the metrological characteristics of mass comparators, I studied methods for determining the reproducibility, repeatability, sensitivity, linearity of the scale and the differences between the pan (automatic mass comparators).

To ensure metrological traceability from the national standard of the unit of mass to the reference and working force and pressure measuring instruments, I studied the methodology for calibrating dead weights.

To improve calibration services in the field of small volume, I studied the fundamental principles of calibration of piston-operated volumetric apparatus using the gravimetric method in accordance with the standards of the ISO 8655 series and the ISO / TR 20461 standard.

Also in the course of the project, I have studied:

- methods for calculating the instability and drift of measuring instruments, to control the metrological characteristics of measuring instruments;
- calculation of the intercalibration interval of measuring instruments;
- procedure for selecting the mass of the comparator, for calibrating weights of various accuracy classes;
- method of checking the residual magnetization of weights;
- presentation of measurement results to the customer in calibration certificates;
- method of cleaning weights;
- methods for checking the measurements.

I also would like to note that I received a lot of information during a two-day seminar conducted by employees of BIPM International Liaison and Communication Department and TUBITAK UME, which I will try to transfer my knowledge to my colleagues.

Conclusions and Future Work

At UzNIM, I plan to revise the existing calibration procedures for mass measuring instruments and establish new procedures as necessary, create programs for calculating measurement results based on the new calibration procedures and calibrate all of my reference and working measuring instruments based on the new procedures.

I also want to begin recording a new history of all measuring instruments in the laboratory of the national standard for the unit of mass for the analysis and control of their metrological characteristics.

Also, in the near future I plan to establish primary level mass standards for the Republic of Uzbekistan.

I also plan to transfer my knowledge to staff of my institute in the field of calculating instability, drift and the intercalibration interval of measuring devices.

Acknowledgements

First of all, I would like to thank BIPM and TUBITAK UME for this opportunity of learning and implementing the project from one of the leading experts in the world.

I also wanted to thank Mr. Andy HENSON and Mr. Chingis KUANBAYEV of the BIPM International Liaison and Communication Department and Mr. A. Ömer ALTAN and Ms. Hanen TIR of the International Relations Department of TUBITAK UME for organizing this project at the highest level.

I would also like to thank and express my deepest respect for the time spent on my training and implementation of my project, and on-going support to the Head of TUBITAK UME Mass Laboratory Ms. Sevda KAÇMAZ, and Researchers Ms. Lenara KANGI and Mr. Cengiz YILMAZ.

I would also like to thank the Head of the Volume, Density & Viscosity Laboratory, Mr. Ümit Yüksel AKÇADAĞ for the help and time spent on my training in the small volume field.