

NMIJ Newsletter

No.2, November 2015



National Metrology Institute of Japan

Welcome to the second issue

I am pleased to announce the new issue of NMIJ Newsletter, which aims to keep you updated with NMIJ's latest topics. This issue focuses on newly-reorganized four research institutes and an administrative unit, which constitute NMIJ. Also introduced are recent events and activities.

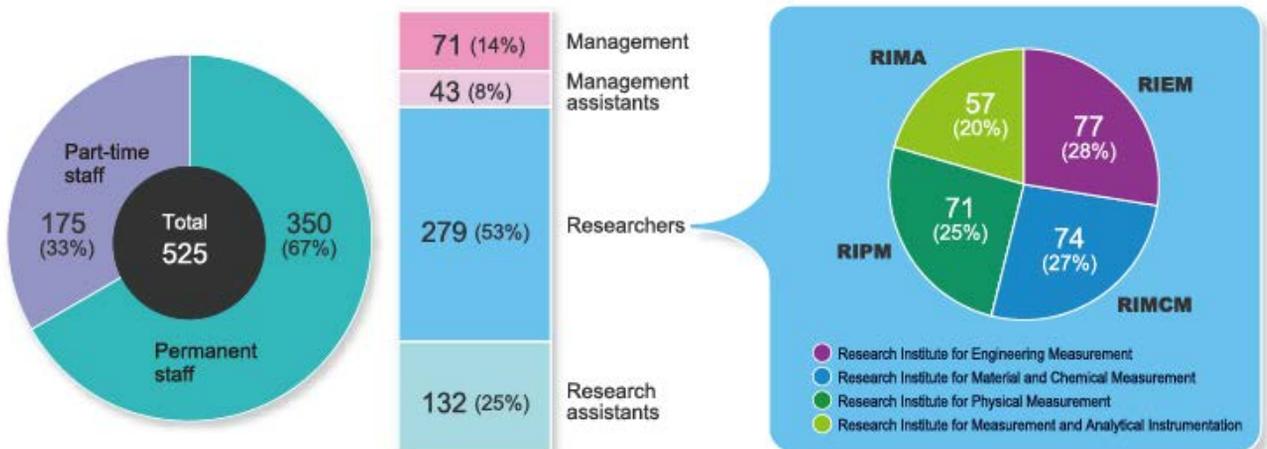
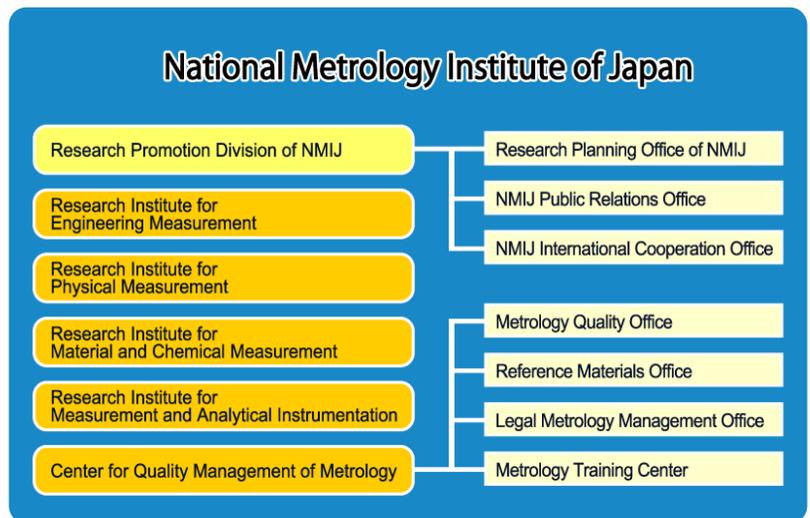


Dr. Yukinobu Miki
Director General of NMIJ

New research institutes and center

As announced in the first issue, NMIJ has been reorganized into four research institutes, the Center for Quality Management of Metrology, and the Research Promotion Division.

At the starting point (April 1st, 2015), NMIJ has 279 researchers and in total, 525 personnel as below. Missions of newly-organized institutes and the center are explained on the next page.



New organization of NMIJ and personnel distribution.

Research Institute for Engineering Measurement (RIEM)

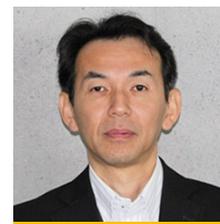
is to develop measurement technologies and the national measurement standards including dimensional, mass, mechanical, flow, and related quantities, which are indispensable in manufacturing industry. Utilizing through these technologies and standards, we provide measurement solutions required by industrial users. RIEM also investigates metrological standards for the next generation such as the mass standard realized by the accurate measurement of Avogadro constant. In addition, RIEM contributes to conformity assessment, for example industrial standardization, international standardization and accreditation. Legal metrology is another important task in RIEM, which helps to protect consumers in the commercial transaction. Type approval and inspection of reference standards used in legal metrology are conducted.



Dr. Toshiyuki Takatsuji
Director of RIEM

Research Institute for Physical Measurement (RIPM)

is to develop the national measurement standards and measurement/evaluation technologies such as electricity, electromagnetic wave, time and frequency, thermometry and photometry, and also to apply these technologies to the industry. The electrical standards based on the quantum effects of current, voltage, resistance, impedance, etc. contribute to improvement of the credibility and development of new technologies of electrical measurement. Radio-frequency electric standards, electromagnetic field, antenna and frequency standards contribute to upgrading information technologies and evaluating electromagnetic wave generated by electronic devices. The thermometry standards are vital for manufacturing process of semi-conductor and materials. The photometry technology for new illuminant is expected to be applied in various fields of industry.



Dr. Yasuhiro Nakamura
Director of RIPM

Research Institute for Material and Chemical Measurement (RIMCM)

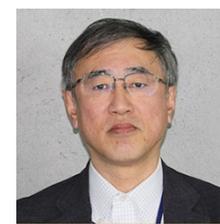
is to supply the national metrology standards and reference materials, and to develop related measurement/evaluation technologies, which contribute to material/chemical industries. Especially, pH standard solutions support the basis of chemical analysis. Bio-related reference materials and organic standard reference materials are essential to our safety of life and food. Advanced material based reference materials are used in development and production of high-quality industrial products. In addition, RIMCM maintains and updates reliable databases which are used in the field of materials, metrology, and evaluation technologies.



Dr. Toshiyuki Fujimoto
Director of RIMCM

Research Institute for Measurement and Analytical Instrumentation (RIMA)

is to develop and to disseminate national measurement standards of radiation and ultrasonics which are supplied to users in analytical and testing industries, such as therapeutic standards for securing reliability of medical equipment. RIMA also aims to research and develop techniques for advanced measurement, characterization, analysis, and testing associated with the national standards such as nano-structure measurement and non-destructive testing. These analysis and measurements are disseminated through analytical and testing industries, and RIMA contributes to build a prosperous and secure society.



Dr. Hidehiko Nonaka
Director of RIMA

Center for Quality Management of Metrology (CQMM)

is to provide calibration/testing services and certified reference materials to support the establishment of reliable metrological traceability chains, e.g. Japan Calibration Service System(JCSS), and also provides technical training and technical information for metrology experts to ensure the national legal metrology system.

For more information: <https://www.nmij.jp/english/info/center/>



Dr. Masaru Arai
Director of CQMM

NMIJ activities (Apr. 2015 – Sep. 2015)

Featured events

Lecture by Prof. Joachim Ullrich (PTB) on “The Silicon Route towards the New SI”

Prof. Dr. Joachim Ullrich, the president of Physikalisch-Technische Bundesanstalt (PTB), Germany visited NMIJ on August 26th-27th and lectured about the Silicon Route towards the New SI.

It is envisaged to redefine the International System of Units (SI) on the next General Conference on Weights and Measures, CGPM 26th meeting, in the year of 2018.

It shall be based on fixing the numerical values of fundamental constants of nature, the “defining constants”: the velocity of light, the charge of the electron, the Boltzmann, the Avogadro and the Planck constants, the Cesium hyperfine clock transition and the luminous efficacy. The International Avogadro Collaboration project (IAC) was started to measure the Avogadro constant by counting the number of atoms in a crystal sphere of enriched silicon. In this lecture, the overview of this challenge was introduced, details of progress and present status of the IAC project were described, and the future perspectives as to the realization after redefinition was also envisioned.



Prof. Dr. Joachim Ullrich, president of PTB



The public open day ended in a great success, providing an opportunity for the younger generation to learn the importance of measurement.

“Public Open Day,” a day for exploring science, attracts visitors

The "AIST public Open Day" was held on July 18th. As part of this event, NMIJ newcomers exhibited their scientific instruments related to measurement, and visitors had a chance to experience various scientific experiments.

The main purpose of this exhibition was to let visitors, particularly children, have fun with science and measurement technology. The newcomers showed a spark chamber for detecting cosmic rays, light-emitting diodes of three primary colors, as well as the replicas of prototype meter and kilogram. Also, the hands-on experiments were demonstrated such as paper chromatography, a game using a balance scale, catching ice using freezing-point depression, and making a sand clock. Many children enthusiastically listened to the explanation and enjoyed the experiments.

For this occasion, RIEM volunteers managed a "hands-on" booth titled "Let's make a mysterious mirror!" with a huge success. Children chosen by lot made corner-cube reflectors, commonly-used in optical experiments. Corner-cube reflectors, which reflect light back in the direction it came from, seemed to interest children.

JASIS conference

The NMIJ organized a seminar and a symposium on the occasion of Japan Analytical and Scientific Instruments Show (JASIS) at Makuhari Messe International Convention Complex on September 3rd-4th.

About 130 participants joined the seminar titled "Water analysis and reference materials for good health" organized by RIMCM. The Symposium by RIMA, "Combining metrology standards with measurement & analysis" was attended by 130 people.



Key note speech at NMIJ Symposium.

Promotion of the new SI

The NMIJ has arranged the new SI units display at the entrance hall of NMIJ main building. The seven SI base units are explained with samples and models. Also, NMIJ contributes to holding lectures and symposiums regarding the new SI on request.



Replica of silicon sphere and unit cells of silicon single crystal on display.



Dr. Takashi Usuda presented a lecture regarding the new SI on the open day at AIST Chubu in Nagoya city on August 1st. He explained the history of the metric system and background of the revision of the SI to citizens and school children.

Invited talk at the CIE 2015 Manchester meeting



Dr. Takashi Usuda, the Assistant Director General of NMIJ and a CIPM member, was invited to the CIE (International Commission of Illumination) meeting in Manchester on June 30th and talked about "CCPR activities and the CIPM MRA" as the President of Consultative Committee for Photometry and Radiometry (CCPR) under the Metre Convention. This was a celebrative talk with reference to the International Year of Light initiated by the UNESCO.

For more information : http://session2015.cie.co.at/keynote_speakers

Visitors

Many foreign guests visited NMIJ for technical discussions and a series of training. Ongoing and future collaborations were discussed with the guests listed below.



The members of Ministry of Trade, Indonesia visited NMIJ on September 7th.

Name	Affiliation	Date	Topic
Dr. Jungjae Park, Dr. Jae-Heun Woo	KRISS, Korea	Apr. 09 – 10	Mutual cooperation on lengths and dimensions metrology between NMIJ and KRISS
Dr. Yong-Hyeon Yim	KRISS, Korea	June 15 – 28	Development of highly accurate quantification method by mass spectrometry (by JSPS invitation Fellowship)
Dr. Jinjin Li, Mr. Qing Zhong, Mr. Yuan Zhong	NIM, China	June 29 – July 02	Possible cooperation between NMIJ and NIM China
Dr. John Hartnett	University of Adelaide, Australia	June 24 – July 02	Development of ultra-stable cryocooled sapphire oscillators
Dr. Marco Antonio Avila-Calderon	CENAM, Mexico	Aug. 24 – Sep. 04	Cooperation for developing techniques for accurate analysis of pesticide in food between NMIJ and CENAM
Prof. Dr. Joachim H. Ullrich	PTB, Germany	Aug. 25 – 26	Lab visit and development of mutual collaboration
Dr. Prayoon Shiowattana	NIMT, Thailand	Aug. 28	Development of mutual collaboration
Mr. Majed Sultan Ali AlSenaidi	Abu Dhabi Quality and Conformity Council, UAE	Aug. 28 – Sep. 04	Technical training for the evaluation of the standard angle measurement system
Dr. Jin Seog Kim, Mr. Kwang Sup Kim, Dr. Jeongtae Lee, Mr. Jae Hyeob Lee, Mr. Sang Kil Lee	KRISS, Korea	Sep. 01	Lab visit and development of mutual collaboration
Dr. Rudzani Nemutudi	iThemba LABS, South Africa	Sep. 01	Lab visit and discussion on radioactive measurement and analysis
Ms. Chandrini Mestika Dewi, Mr. Venly Wahyu Nugroho, Ms. Julia Silalahi	Ministry of Trade, Indonesia	Sep. 07	Development of mutual collaboration
Dr. Kuo-Wei Lee	INER, Taiwan	Sep. 09	Neutron calibration of the INER instruments at NMIJ
Dr. J.T. Janssen, Mr. Tim Prior	NPL, UK	Sep. 24	Possible cooperation between NMIJ and NPL
Dr. Tepiwan Jitwatcharakomol, Mr. Wanchai Chinchusak, Dr. Acharawan Wattanahuttakum, Dr. Jittakant Intiang, Dr. Pasan Kulvanit	DSS, Thailand	Sep. 29 – Oct. 01	Lab visit and development of mutual collaboration
Dr. Siaudinyte Lauryna	Vilnius Gediminas Tech. University, Lithuania	Sep. 29 – Oct. 02	Cooperation for research on angle encoder accuracy

Peer review

The NMIJ sends the peer reviewers to NMIs on their requests (if available). In the recent half year, eight researchers were sent to four NMIs for CIPM on-site peer reviews. The NMIJ also accepts on-site peer review for CIPM MRA. In this period, we invited a peer reviewer in the thermometry area.

International comparisons

The NMIJ has participated in the following key and supplementary comparisons within this period.

KCDB Code	Title	Pilot Lab
APMP.QM-S2	Oxygen in Nitrogen at atmospheric level (~ 0.2 mol/mol)	NMIJ
APMP.T-K6	Comparison of humidity standards: dew point temperature	NMC, A*STAR
APMP.T-K8	Comparison of high dew point temperatures	NMIJ
APMP.T-S13	Low-frost-point temperature (Temperature: from -60 °C to -90 °C)	NMC, A*STAR
BIPM.RI(I)-K3	Measurement of air kerma for medium energy X rays	BIPM
CCAU.V-K3	Acceleration complex sensitivity (Low-frequency vibration comparison)	NIM
CCQM-K55.d	Purity assessment of high purity organic materials: Folic Acid	BIPM
CCQM-K90	Formaldehyde in Nitrogen (~ 10 µmol/mol)	BIPM, NIST
CCQM-K116	Water vapor in Nitrogen (10 µmol/mol)	NPL
CCQM-K125	Iodine and other elements in infant formula	GLHK
CCQM-K127	Toxic and trace elements in soils	CENAM, ISJ
CCQM-K131	Mass fraction of organic calibration solution	NIST
CCQM-P160	Isotope ratios and molar mass of highly enriched silicon	PTB

Selected research reports

- 1) T. Tanaka, M. Kato, N. Saito, K. Tono, M. Yabashi and T. Ishikawa, "Room-temperature calorimeter for X-ray free-electron lasers", *Review of Scientific Instruments*, 2015, 86 (9), 93–104
- 2) T. Yarita, Y. Aoyagi and T. Otake, "Evaluation of the impact of matrix effect on quantification of pesticides in foods by gas chromatography-mass spectrometry using isotope-labeled internal standards", *Journal of Chromatography A*, 2015, 1396, 109–116
- 3) Y. Yamaguchi, Y. Yamada and J. Ishii, "Supercontinuum-source-based facility for absolute calibration of radiation thermometers", *International Journal of Thermophys*, 2015, 36, 1825–1833
- 4) J. V. Widiatmo, K. Harada, K. Yamazawa, J. Tamba and M. Arai, "Electrical effect in silver-point realization due to cell structure and bias voltage based on resistance measurement using AC and DC bridges", *International Journal of Thermophysics*, 2015, 36 (8), 2002–2026
- 5) K. Amemiya, H. Koshikawa, T. Yamaki, Y. Maekawa, H. Shitomi, T. Numata, K. Kinoshita, M. Tanabe and D. Fukuda, "Fabrication of hard-coated optical absorbers with microstructured surfaces using etched ion tracks: Toward broadband ultra-low reflectance", *Nuclear Instruments & Methods B*, 2015, B-356, 154–159
- 6) N. Matsumoto and T. Shimosaka, "Purity analyses of high-purity organic compounds with nitroxyl radicals based on the Curie-Weiss law", *Journal of Applied Physics*, 2015, 117 (17), 17E114
- 7) S. Shibayama, H. Sakamaki, T. Yamazakia and A. Takatsu, "Metal free columns for determination of deoxynucleotide-monophosphate by liquid chromatography/mass spectrometry and application to oligonucleotide Sachie", *Journal of Chromatography A*, 2015, 1406, 210–214
- 8) I. Misumi, K. Naoi, K. Sugawara and S. Gonda, "Profile surface roughness measurement using metrological atomic force microscope and uncertainty evaluation", *Measurement*, 2015, 73, 295–303
- 9) M. Ishibashi, "Discharge coefficient equation for critical-flow toroidal-throat venturi nozzles covering the boundary-layer transition regime", *Flow Measurement and Instrumentation*, 2015, 44, 107–121