The 15th meeting of the CCM
26-27 February 2015 at the BIPM

APMP TCM Activity Report

Chair of TCM: Tokihiko Kobata (NMIJ/AIST)

Activities in APMP TCM

- TCM: Technical Committee for Mass and Related Quantities
  - Mass, Force, Torque, Pressure, Vacuum, Density, Hardness, Gravity.

- Activities in TCM
  - Periodic meetings and workshops.
  - Linkage of APMP activities to CCM of the CIPM and to TCM in other RMOs.
  - Management and cooperation of APMP key, supplementary, and pilot comparisons.
  - Cooperation in building and claiming Calibration and Measurement Capabilities (CMCs) of member economies in APMP

Photo of APMP 2013 TCM

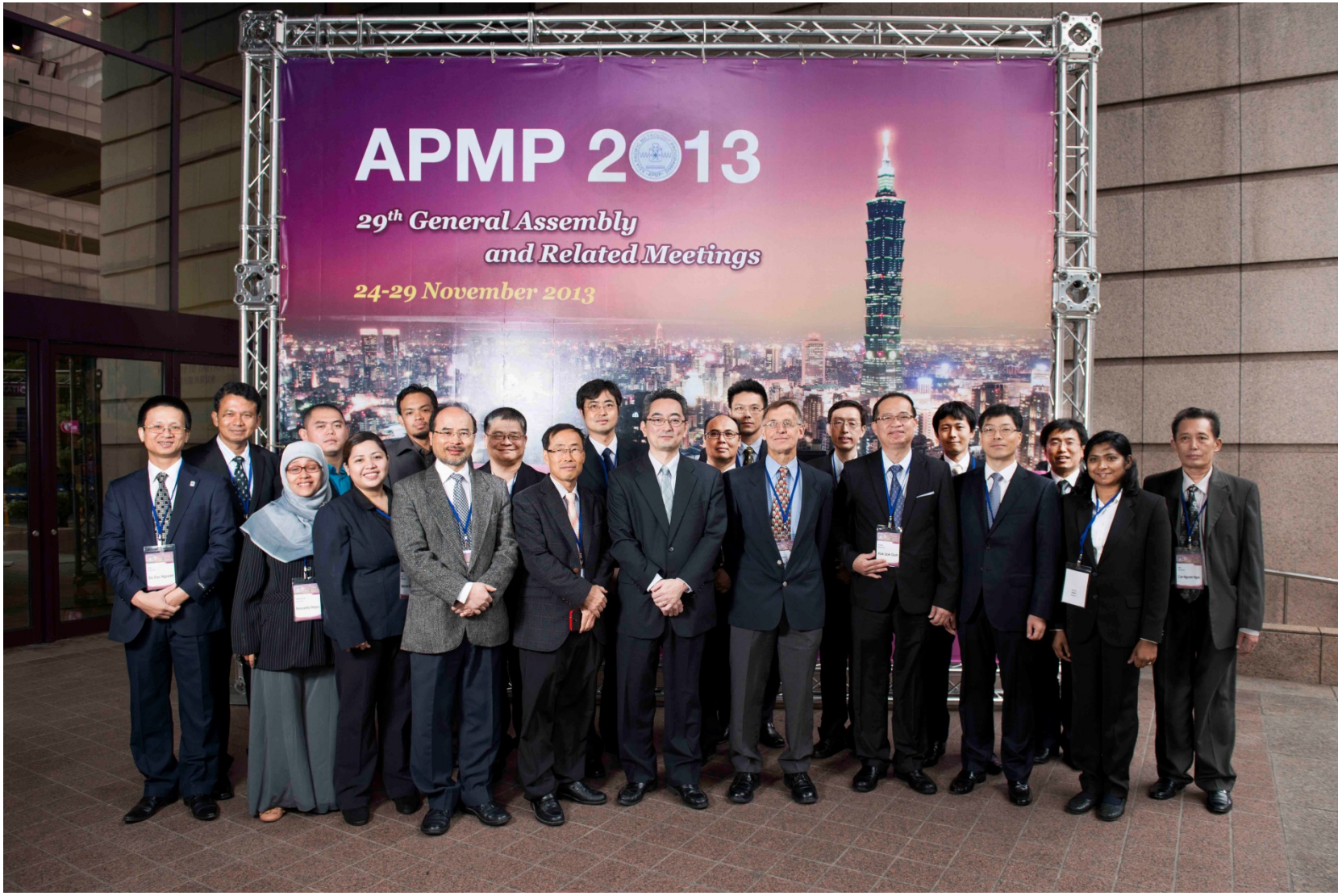
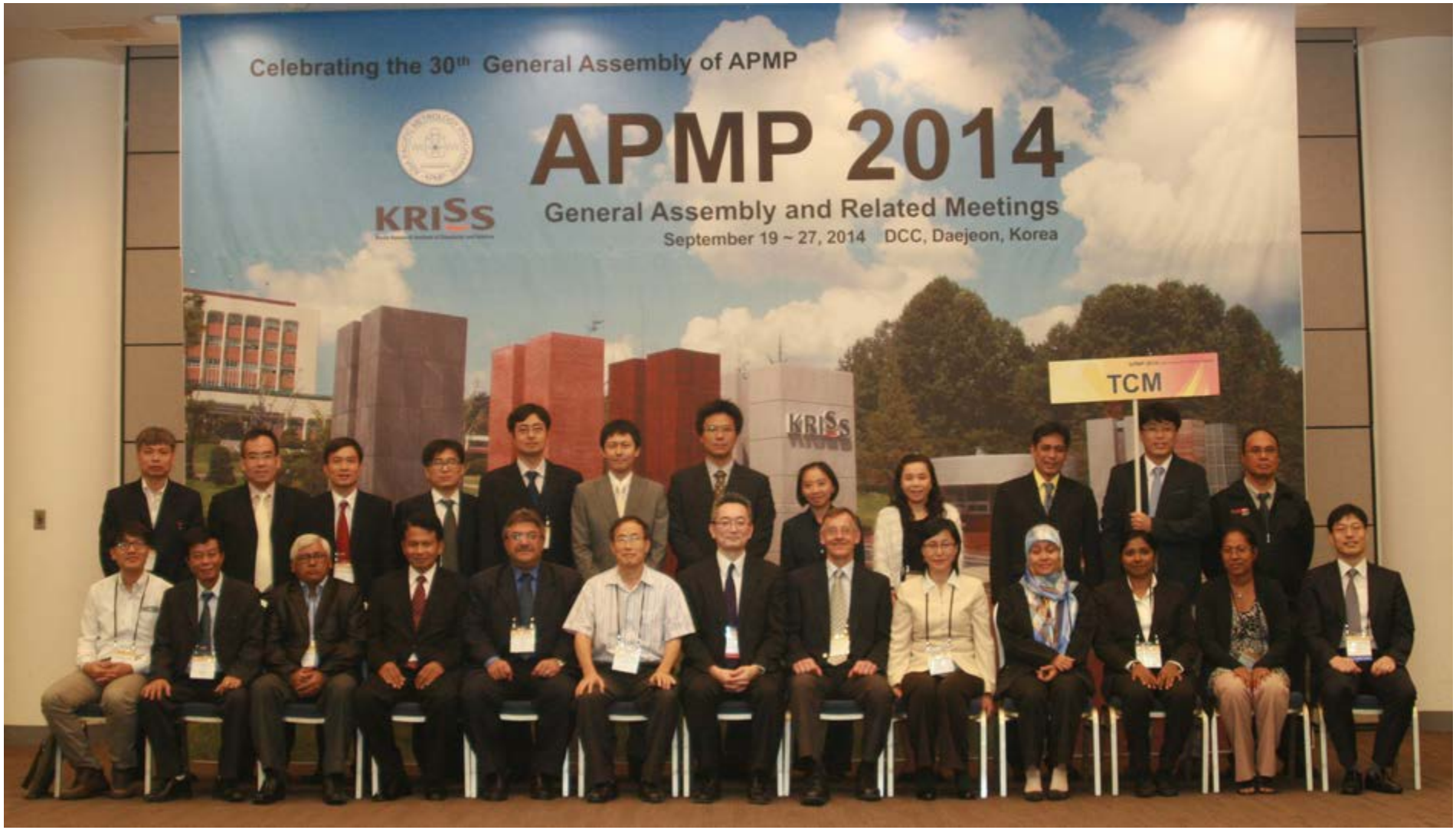


Photo of APMP 2014 TCM



APMP TCM strategic document

- Identify three issues faced by the region to which your TC needs to respond;
  - Activities currently dominated by redefinition and continuation of most traditional activities
  - Consideration of new MRQ standard needs as well as needs for traceability of dynamic measurements
  - Planning and Implementation of APMP key comparisons

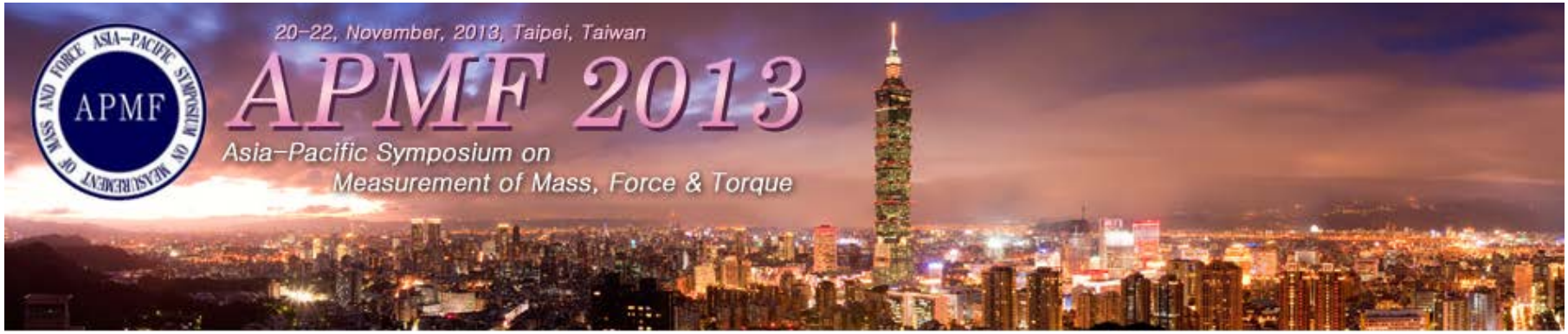
- Provide a discussion on how your TC might respond to these issues;
  - Coordinate closely with the CCM and the related WGs
  - Enhance information sharing among members in APMP TCM
  - Convene TCM associated workshop and related conference regularly
  - Encourage mutually beneficial collaborations on developments of common interest
  - Reduce effort on measurement comparisons

- What resourcing might be required and what benefit is likely to arise from the response.
  - Resource: Finance and human support (research, comparison, workshop)
  - Benefit: Enhance cooperative relations with other RMOs on an equal footing

TCM Associated Workshop and Related Conference [since last CCM]

11th Asia-Pacific Symposium on Measurement of Mass, Force and Torque (APMF, 2013), Taipei, Taiwan (20-22 November 2013)

- Organized by Center for Measurement Standards, ITRI
- Co-sponsored by IMEKO TC3



TCM Associated Workshop and Related Conference [since last CCM]

IMEKO 2014 Mass, Force, Torque, Hardness, Vibration conference

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7th APMP Pressure and Vacuum Workshop (19-20 Sep. 2014)

– Organized by KRISS (Korea)

Future TCM Associated Workshop and Related Conference

- 12th Asia-Pacific Symposium on Measurement of Mass, Force and Torque (APMF 2015) (Oct., 2015)
  - Seoul, Korea

- IMEKO XXI World Congress (August30 - September 4, 2015)
  - Prague, Czech Republic

Approved and published comparison since last CCM

- Pressure:
  - 1.77 MPa to 6.8 MPa Supplementary pressure comparison, APMP.M.P-S3
    - Pilot lab is NMIA. Participants (2): INRIM, NMIA.
    - Approved for equivalence
    - Reference(s): *Metrologia*, 2013, **50**, *Tech. Suppl.*, 07007
      APMP.M.P-S3 Final Report, 2013, 36 pages
  - 60 kPa to 350 kPa Supplementary pressure comparison, APMP.M.P-S4
    - Pilot lab is NIMT. Participants (2): NIMT, PTB.
    - Approved for equivalence
    - Reference(s): *Metrologia*, 2013, **50**, *Tech. Suppl.*, 07009
      APMP.M.P-S4 Final Report, 2013, 18 pages
  - Gauge pressure comparison (50 MPa-500 MPa), APMP.M.P-K13
    - Pressure balance is used as transfer standard. Pilot lab is NMIJ. Participants (9): NMIJ, KRISS, KIM-LIPI, NIM, NIMT, NMC A*STAR, NPLI, CMS-ITRI, NMIA.
    - Approved for equivalence
    - Reference(s): *Metrologia*, 2015, **52**, *Tech. Suppl.*, 07003
      APMP.M.P-K13 Final Report, 2015, 49 pages

TCM main ongoing comparisons (1/5)

- Mass:
  - Mass Comparison, APMP.M.M-K5
    - Pilot lab is NIM. Participants (19): NIM, NMIA, SCL, NMIJ, NMC A*STAR, NPLI, NML-SIRIM, NIMT, KRISS, MSL, MUSSD, KIM-LIPI, VMI, ITRI, NML-BSTI, NML-Phil, MASM, NIS, NISIT. Protocol preparing.
  - Mass Comparison, APMP.M.M-K1.2
    - Pilot lab is KRISS. Participants (2): KRISS, NMC, A*STAR. Report in progress, Draft A.
  - Mass Comparison, APMP.M.M-K2.2
    - Pilot lab is KRISS. Participants (2): KRISS, NIMT. In progress.
  - Pilot study on National prototype of kilogram
    - piloted by KRISS and co-piloted by NMC, A*STAR. They have already circulated the transfer prototype. Participants (10): KRISS, SCL, NIM, NMIT, NMIJ, CMS, A*STAR, NMIA, NPLI, KIM-LIPI. Report in progress.

TCM main ongoing comparisons (2/5)

- Density:
  - Hydrometer Comparison, APMP.M.D-K4
    - Pilot lab is KRISS. Participants (11): KRISS, MSL, NIM, NMIT, NMIA, NMIJ, NMISA, NMLPHL, KIM-LIPI, NML-SIRIM, NPLI. Draft A report in progress.

- Hardness:
  - Hardness (Rockwell C) Comparison, APMP.M.H-S4
    - Pilot lab is KRISS. Participants (2): KRISS, NMIJ. Draft A report in progress.

TCM main ongoing comparisons (3/5)

- Force:
  - 50 kN and 100 kN force comparisons, APMP.M.F-K2
    - Pilot lab is KRISS. Participants (13): KRISS, A*STAR, ITRI, KEBS, KIM-LIPI, NIMT, NIS, NMIJ, NML-SIRIM, NPLI, SCL, VMI, NIM, Report in progress, Draft A (Measurement finished).
  - 0.5 MN and 1 MN force comparisons, APMP.M.F-K3.a and APMP.M.F-K3.b
    - Pilot lab is NIM. Participants (6): NIM, A*STAR, KIM-LIPI, NIMT, NMIA, NMIJ. Measurement in progress.
- Torque:
  - Torque comparisons, (APMP.M.T-K1)
    - Pilot lab is KRISS. The questionnaire will be sent to potential participants in APMP region soon. KRISS has been equipped with two torque transfer artifacts and testing their characteristics.
    - supported by APMP TC Initiative 2012
- Gravity:
  - Free-fall acceleration comparisons, (APMP.M.G-S1)
    - Pilot lab is NIM. Participants (2): NIM, KRISS. Report in progress, Draft A.

TCM main ongoing comparisons (4/5)

- Pressure and Vacuum:
  - Pressure comparison (1 MPa - 10 MPa), APMP.M.P-K1.c.2
    - KRISS is pilot lab. Participants (2): KRISS, NIM. Preparing Draft B.
  - Absolute pressure comparison (10 kPa-110 kPa), APMP.M.P-K9.
    - Precise digital pressure gauges are used as transfer standard. KRISS is pilot lab. Participants (17): KRISS, NML-SIRIM, KIM-LIPI, MSL, NIM, NIMT, NIS,NMC A*STAR, NMISA, NSCL, SCL, PTB, NPLI, VMI, NMIJ, CMS-ITRI, NMIA. Draft A in progress
  - Vacuum comparison (0.1 mPa-1 Pa), APMP.M.P-K14
    - Two sets of SRG are used as transfer standard. NMIJ is pilot lab. Participants (7): NMIJ, NMIA, NIM, CMS/ITRI, A*STAR, KRISS, NPLI. Measurement in progress.

TCM main ongoing comparisons (5/5)

- Pressure and Vacuum:
  - Gauge Pressure comparison (Hydraulic, 1 MPa - 10 MPa), APMP.M.P-S5.
    - Pressure balance is used as transfer standard. NIM is pilot lab. Participants (2): NIM, PTB. Measurement in progress.
  - Gauge Pressure comparison (Gas, 10 MPa – 100 MPa), APMP.M.P-S6.
    - Precise digital pressure gauges are used as transfer standard. NMIJ is pilot lab. Participants (2): NMIJ, NIST. Measurement finished.
  - Gauge Pressure comparison (Hydraulic, 50 MPa – 500 MPa), APMP.M.P-S7
    - Pilot lab is NIMT. Participants (2): NIMT, LNE. Planned.
  - Absolute Pressure comparison (Gas, 1 Pa to 10 kPa), APMP.M.P-K4
    - Pilot lab is KRISS. Participants (not yet determined): KRISS, NMIJ, , , . Planned.

Candidates of TCM key comparison

Proposed for Discussion

•50 kg comparison: linked to CCM.M-K6, which KRISS and NMIJ participate in

•Differential pressure requested by NMC/A*STAR, NMIA, CMS-ITRI, VMI and NIM, 1 Pa -10 kPa (line pressure: absolute about 100 kPa), MSL or NMIJ be included

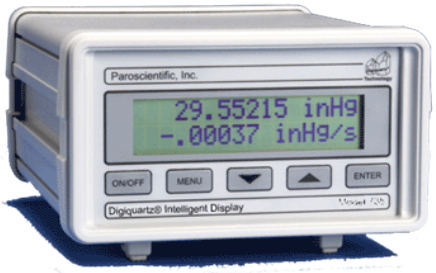
•Nano force pilot study: AFM cantilever stiffness comparison

•Brinell Hardness and Vickers Hardness

•Hydraulic pressure 0.1 MPa - 10 MPa

APMP TC Initiative Project Application 2013 proposed by TCM

- Title of Project:
  - Characterization and successive maintenance of the transfer standard for APMP comparison of hydraulic pressures
- Project Overseer:
  - Dr. Hiroaki Kajikawa, Senior Researcher, NMIJ/AIST



- Total : US$ 10,000
  - Item Budget (in US$) Purpose
  - Pressure sensor (Paroscientific,Inc. MODEL 745) :
    - To be characterized and used as a transfer standard for APMP comparison of hydraulic pressures
  - Consumable goods:
    - Pipings and oil for characterization

CMC submission and status since last CCM

NMI	Field (JCRB code)	Status
NPLI (India)	Force, torque, hardness (APMP.M.25.2010)	Published in the KCDB in Mar., 2014
NIMT (Thailand)	Mass and density (APMP.M.32.2013)	Published in the KCDB in Aug., 2013
NML-PHIL (Philippines)	Mass (APMP.M.33.2013)	Published in the KCDB in Dec., 2013
KRISS (Korea)	Mass and related quantities (APMP.M.36.2014)	Published in the KCDB in Dec., 2013
CMS/ITRI (Chinese Taipei)	Mass, force, pressure, vacuum, hardness (APMP.M.37.2014)	Published in the KCDB in Jan., 2015

Next APMP TCM Chair

LEE SHIH MEAN

Senior Metrologist (Mechanical Metrology)

National Metrology Centre (NMC)

Agency for Science, Technology and Research (A*STAR)

He is the Senior Metrologist in-charge of the primary Mass & Force laboratory in the National Metrology Centre, A*STAR. He is responsible for the scientific work related to the establishment, maintenance and dissemination of the SI measurement quantity for mass, the kilogram, in Singapore. He is responsible for establishing the primary mass laboratory; the setting up and maintenance of the national mass standard; and the dissemination of the mass values through providing mass and balance calibration services to the industries. He has had over 20 years of broad experience in various mechanical measurement and calibration areas, namely in the mass, force, torque, hardness, acoustic & vibration and dimensional metrology fields.

Next APMP TCM meeting planned

- The 16th Meeting of APMP-TCM
  - 2-3 November 2015 Beijing, China
  - Hosted by NIM

End of Report

Thank you for your attention!