

Minutes of the 2019 Meeting of the APMP Technical Committee for Time and Frequency

International Convention Centre, Darling Harbour, Sydney, Australia. 2–3 December, 2019.

Minutes taken by R. J. Williams, revised by Yuzhuo Wang and Aimin Zhang...

I. Participants

In total, 24 individuals representing 15 institutes in 14 economies participated in the 2019 meeting of the TCTF. The meeting was held at the International Convention Centre in Sydney on December 2nd (full day) and 3rd (half day), 2019.



| No. | Institute | Economy | Participant |
|-----|-----------|----------------|------------------------|
| 1 | A*STAR | Singapore | Yusong Meng |
| 2 | KRISS | Korea | Dai Hyuk Yu |
| 3 | KRISS | Korea | Ho Seong Lee |
| 4 | KRISS | Korea | Jae Hoon Lee |
| 5 | MSL | New Zealand | Adam Dunford |
| 6 | NICT | Japan | Tetsuya Ido |
| 7 | NICT | Japan | Tadahiro Gotoh |
| 8 | NIM | China | Aimin Zhang |
| 9 | NIM | China | Yuzhou Wang |
| 10 | NIMT | Thailand | Piyaphat Phoonthong |
| 11 | NMIA | Australia | Michael Wouters |
| 12 | NMIA | Australia | Louis Marais |
| 13 | NMIA | Australia | Robert Williams |
| 14 | NMIJ | Japan | Masami Yasuda |
| 15 | NMIJ | Japan | Daisuke Akamatsu |
| 16 | NMIM | Malaysia | Ahmad Sahar Bin Omar |
| 17 | NMISA | South Africa | Pritesh Prakash Jivan |
| 18 | NML-ITDI | Philippines | Paulo Leones |
| 19 | NPLI | India | Ashish Agarwal |
| 20 | SNSU-BSN | Indonesia | Ahmad Mohamad Boynawan |
| 21 | SCL | Hong Kong | Steven Yang |
| 22 | TL | Chinese Taipei | Chia-Shu Liao |
| 23 | TL | Chinese Taipei | Huang-Tien Lin |
| 24 | TL | Chinese Taipei | Po-Cheng Chang |

II. Day 1: Opening and Chair's Report

A. Opening and Adoption of the Agenda (A. Zhang)

Apologies from Mr Perera (MUSSD), Dr G Gomah (NIS), for being unable to attend were given to the meeting. Delegates to the TCTF introduced themselves.

The Minutes from the 2018 meeting were presented and accepted.

The Agenda as circulated prior to the meeting was presented and additions and amendments were invited. Item 5.6 (New proposal for MEDEA 2.0) was replaced by election of a DEC champion.

B. Chair's Report (A. Zhang)

The Chair's report is available as a presentation on the TCTF website.

Dr H-T Lin (TL) was thanked for organizing the ATF workshop and for arranging publication of workshop papers in the IJEE.

TCC Actions and Resolutions was presented.

Q. What is a Hybrid Comparison? (M. Wouters, NMIA)

A. Routine calibration conducted by NMIs and DIs to support the submission of CMCs in some cases. .

III. Day 1: Institutional Reports

Short reports from each institute participating in the meeting were presented and discussed. Individual presentations are available on the TCTF website and are not summarised here.

A. KRIS (D-H. Yu)

Q. What is the carrier frequency of the low-frequency test station? (L. Marais, NMIA)

A. 65 kHz.

Q. What is the software for IPPP? Is it written as custom software or as modules that plug into Bernese or GIPSY? (M. Wouters, NMIA)

A. As modules for both GIPSY and Bernese.

Q. What limits the stability of your Yb clock laser if not thermal stability? (T. Ido, NICT)

A. One factor is the suspension point of the ULE cavity.

Q. What kind of optical fibre grid do you use for time and frequency transfer (TFT)? How long is the link? (A. Agarwal, NPLI)

A. Optical fibre TFT is now well-developed. We currently use our own, but will use commercial in the future. 500 km.

B. NICT (T. Ido)

Q. What is the uncertainty for the Hikari telephone clock service? (S. Omar, NMIM)

A. Less than a millisecond.

Q. Normally for VLBI, aren't large antennas needed? (P. Phoonthong, NIMT)

A. No, only one large antenna is needed. We have one large antenna to provide large signal-to-noise ratio, and two small ones.

Q. For the CSAC do you use Rb? Is there an integrated filter cell to filter out the unwanted light? (A. Agarwal, NPLI)

A. We use Rb. It's CPT based, so a filter is not needed.

Q. What will be the final size of your CSAC? (D-H. Yu, KRISS)

A. It should ultimately sit inside a phone. About 10x10 mm. We need to make the height lower.

C. MSL (A. Dunford)

Q. What is your technique for calibrating police speed measurement units? (P. Phoonthong, NIMT)?

A. We don't do those calibrations, they're done internally by the police force. We calibrate the units used by their calibration labs.

D. NIM (Y. Wang)

Q. What is the difference between your first and second Sr clocks? (T. Ido, NICT)

A. Not sure of the technical details, but there is improved stability and reduced uncertainty.

Q. You can measure the Ca clock frequency using TWSTFT or GNSS, so is there any reason to move the clock to NIM? (D-H. Yu, KRISS)

A. In our group we use GNSS to compare, but we moved the clock to provide lower uncertainty.

E. NIMT (P. Phoonthong)

Q. Why do you use an FPGA for your PMT counting? Is it / do you need multichannel? (M. Wouters, NMIA)

A. We had a spare FPGA channel. It's single channel.

Q. Question regarding the temperature monitoring of the Cs tube? (P. Leones, NML-ITDI)

A. Answer not recorded.

F. NIMA (M. Wouters)

Q. Do you have any plans to purchase new hydrogen masers? (A. Zhang, NIM)

A. Not at the moment. We do have a plan to buy newer and better clocks, maybe a passive H maser or a cold atom clock, but in the long term due to budget constraints.

Q. What is the wavelength you use for comb calibrations? (T. Ido, NICT)

A. The comb runs at 1.5 μm , but with second-harmonic generation and nonlinear fibre it covers a variety of wavelengths. All our calibrations are at 633 nm.

G. NMIJ (M. Yasuda)

Q. Have you started using the Deep Learning to steer UTC(NMIJ)? (A. Zhang, NIM)

A. Not at the moment.

Q. Do you report the output of the Cs fountain to the BIPM? (A. Zhang, NIM)

A. Not yet. We haven't finalized the evaluation of our uncertainties.

Q. Regarding the Deep Learning, to clarify, do you pass in past data? (T. Ido, NICT)

A. Yes, we pass in past data in order to predict future performance.

Q. How small can you make the Yb clock? (J-H. Lee, KRISS)

A. The vacuum system can be roughly the size of two fists.

Q. How many atoms are trapped? (DH Yu, KRISS)

A. Much more than a clock with a Zeeman slower.

H. NMISA (P. Jivan)

Q. How are you doing your speed calibration? (S. Omar, NMIM)

A. We're still working it out. We have purchased equipment and made initial test procedures.

Q. Who calibrates the police speed guns at present? (P. Leones, NML-ITDI)

A. The suppliers.

I. NMIM (A S bin Omar)

Q. Is there regulation stipulating that the Time Stamping Service should be traceable? (D-H. Yu, KRISS)

A. Yes, the regulator has asked for this.

Q. Does your NTP monitoring equipment require a combination of hardware and software customization? (A. Agarwal, NPLI)

A. We have asked the NTP vendor to customize their systems so that we can monitor client synchronization.

Q. Do you use regular network monitoring software? (A. Agarwal, NPLI)

A. This is embedded in the NTP server.

Q. How many clients are there for the NTP private so far? (A. M. Boynawan, SNSU-BSN)

A. Two confirmed.

Q. Within the laws you mentioned, is there anything related to time and frequency? (A. Zhang, NIM)

A. Yes, we are the appointed time keeper, but each regulator has to put things into their own regulation so that we can support them.

J. NML-ITDI (P. Leones)

Q. What is the temperature in your laboratory? (A. Zhang, NIM)

A. $(20 \pm 1) \text{ }^\circ\text{C}$

K. NPLI (A. Agarwal)

Q. Is your backup timescale traceable to your primary timescale? What is the range of deviation? (A. Zhang, NIM)

A. Yes it is traceable. The backup is within ± 5 ns of the primary. The comparison is GPSCV.

Q. What clock infrastructure is proposed for the new time centres? (M. Wouters, NMIA)

A. India wants Cs clocks. We are talking with Microsemi about turnkey systems. Also active H masers are planned for the disaster recovery centres.

L. SNSU-BSN (A. M. Boynawan)

Q. You have recently published CMCs on BIPM website, why are you having peer review next year? (A. Zhang, NIM)

A. Our last peer review was in 2015.

M. SCL (S. Yang)

Q. Is there a way to evaluate the uncertainty due to long distance between the antenna and your lab, since it is more than 10 floors? Is there additional uncertainty due to amplifiers other than just the time delay offset? (A. Agarwal, NPLI)

A. We only include the time delay offset.

Q. What is the maximum frame rate of your Visualize (stopwatch calibration) system? (S. Omar, NMIM)

A. Some commercially available camera can achieve very high frame rate up to 1 million fps.

Q. Do you have any collaboration with the Hong Kong Observatory, since they are the official timekeeper? (A. Zhang, NIM)

A. Not much regarding time.

Q. How do they disseminate time? (A. Zhang, NIM)

A. Via a webpage, time servers and a telephone service.

Q. Do you and the HK Observatory both contribute to UTC? (A. Agarwal, NPLI)

A. Yes, both do.

N. TL (C. S. Liao)

Q. What kind of hardware do your users need to use the digital timecode in your talking clock service? (M. Wouters, NMIA)

A. Answer not recorded.

Q. How is the performance of your new H maser? (A. Zhang, NIM)

A. It's good.

Q. Your NTP service receives 3 million requests per day. How many servers do you have? (T. Ido, NICT)

A. Five.

IV. Day 1: Activity Reports from Working Groups (WGs)

A. WG on MRA (Y Wang, NIM)

There were no questions.

B. WG on GNSS (M. J. Wouters, NMIA)

There were no questions

C. WG on TWSTFT (P. C. Chang, TL)

(Presented on behalf of Huang-Tien Lin, TL)

Q. Antennas need sensors (temperature, pressure, humidity) – are these in place? (A. Agarwal, NPLI)

A. Follow up with H-T. Lin.

Q. BIPM recommend the same (sensors) for GNSS. Is anyone sending this data? (M. Wouters, NMIA)

Responses. Yes (T. Ido, NICT; A. Zhang NIM)

Q. How is it being sent? (A. Agarwal, NPLI)

A. Logging the data and send to BIPM. (T. Ido, NICT)

Brief discussion followed about data format. (M. Wouters, NMIA; P. Phoonthong, NIMT)

D. Joint TCL/TCTF WG on OFM (M. Yasuda)

Q. Regarding the roadmap for the SI redefinition of the second, what is the projected likely date? (A. Agarwal, NPLI)

A. Perhaps at the 2026 CGPM, but can't be sure.

Q. What do you think is the likely form in which the second will be redefined? (A. Zhang, NIM)

A. Three possibilities: in terms of a single atom, a ratio of two atomic transitions, or a redefinition of the Rydberg constant.

E. WG on Test and Calibration (S. Omar)

Presented TCI progress report on "Comparison of Stopwatch Calibration Methods".

Q. When do APMP expect the TCI report? (S. Omar, NMIM)?

A. End of this year would be preferable. (A. Zhang, NIM)

Comment about KCDB requirements for all results from comparisons to be uploaded. (A. Agarwal, NPLI)

A. We will try our best to fulfil all the requirements as soon as possible.

F. 2019 TCI Project Progress Report: BeiDou Time Transfer and its System Time Traceability to UTC in Asia (A. Zhang, NIM)

Q. You only use BeiDou for time transfer, so is it necessary to compare via UTC(NTSC)? (T. Ido, NICT)

A. Not necessary. Q. Do we have a list of receivers that incorporate BeiDou? (A. Agarwal, NPLI)

A. China has lots of multi-channel, multi-system receivers with BeiDou.

V. Day 1: Other Items

A. NICT Proposal for "ASEAN IVO" (T. Ido, NICT)

There were no questions.

B. Conference Notification (M. Yasuda, NMIJ)

Brief presentation highlighting the URSI GASS 2020 conference, at which there will a joint session on optical frequency metrology.

C. APMP - Hybrid Comparisons for Supporting CMCs (A. Zhang, NIM)

Slides were presented that had been shown at the TC chairs' meeting.

D. G2 GNSS Time Link Collaboration (M. Wouters, NMIA)

M. Wouters presented a proposal for an improved process for organising G2 GNSS receiver calibrations.

Q. What is the calibration fee? (P. Leones, NML-ITDI)

A. No fee, other than transport of the calibrator unit. Each G2 pays for shipping to the next lab (and is responsible for import duties, etc), or for return to the G1 lab for the last G2 lab.

Comment. A few months ago our calibrated receiver was broken. We need to put together a new receiver, and given our limited human resources it would be difficult to do any further calibrations this year. (T. Ido, NICT)

Comment. KRISS has a new receiver that needs calibration. (D. H. Yu, KRISS)

M. Wouters sought feedback on the proposed procedure.

Q. If a calibration is done in April, do we need to wait until December to hear back from the BIPM? (D. H. Yu, KRISS)

Comment. Our experience is that they take a few months to respond. (A. Agarwal, NPLI)

A. That being the case, then with shipping, etc., the proposed timeline seems realistic.

Q. It would be ideal if the calibrating unit was owned by the RMO, but is there funds available? (T. Ido, NICT)

A. We really need a few. TCI funding would not be sufficient.

M. Wouters asked which G2s are requesting calibration this year: NIMT, MSL, NMIA, ?.

Q. Is the January deadline for requesting calibrations a deadline or a window (i.e. is there a start date)? (A. Agarwal, NPLI)

A. It is a deadline. Early requests are fine, but later requests will just be rolled over to the next year.

M. Wouters (NMIA) sought consensus on the proposal. Consensus was given by the room. A. Zhang (NIM) approved the proposed procedure for a one year trial.

VI. Day 2: Update from EMI – GULFMET Time and Frequency Activities

Q. How many laboratories participate in the frequency comparison? (A. Zhang, NIM)

A. Four.

Q. Do you circulate a Rb standard? (A. Zhang, NIM)

A. Yes, Saudi Arabia has one.

VII. Day 2: General Discussion Items

A. ATF Workshop (H. T. Lin, TL)

The ATF Organizing Chair Dr Lin thanked NICT for continuing to host the ATF website.

ATF 2019 participants were encouraged to submit full papers to the IJEE.

Since the IFCS-EFTF joint conference will be in Japan in May 2022, a proposal was tabled that there be an ATF workshop in 2022 combined with this meeting.

Comment was made that combining the ATF workshop with the IFCS-EFTF meeting would provide great benefit to our community as an opportunity to learn about worldwide activities in T&F (T. Ido, NICT), and there was agreement from the room.

It was decided that there would be an ATF meeting in 2022 combined with the IFCS-EFTF meeting.

It was proposed and agreed upon that there be a TCTF workshop in 2021 instead of an ATF meeting.

It was proposed and agreed upon that there be an ATF workshop in 2020 instead of a TCTF workshop.

The need for travel support was highlighted. No one was able to commit now. To be followed up after the meeting.

B. Election of Incoming TCTF Chair

The rules for election were read.

The two candidates for election were D.-H. Yu, KRISS, and A. Agarwal, NPLI.

Each candidate was given five minutes to present their case for election to the meeting.

Ballots were distributed to TCTF members, a few minutes were allowed for voting, then ballots were collected and read aloud by P. Phoonthong (NIMT).

The ballot was won by D.-H. Yu, therefore he was elected the next chair of the TCTF.

C. Progress Report of MEDEA 2.0 Project Application (Y. Hanado, NICT; presented by A. Zhang, NIM)

Preparing tutorial training workshop on timescales and algorithms in Asia – July 1-3 in Thailand. Applied for funding from MEDIA 2.0.

Recently notified of outcome: application for funding support from MEDIA 2.0 was successful.

D. New Proposal for MEDEA 2.0 (A. Zhang, NIM)

Advised that MEDIA 2.0 funds are close to exhausted, therefore APMP are not keen to support new proposals unless there is a critical need. Therefore it was decided not to request support for another GNSS time-transfer tutorial/workshop at this time.

E. Election of DEC Champion (A. Zhang, NIM)

There was a call for each TC to elect a DEC champion to provide a representative voice for DEC's within the TCs.

A. Zhang nominated S. Omar as a suitable candidate and all agreed. Sahar accepted.

F. Confirmation of WG Coordinators, peer reviewers, TCTF members (A. Zhang, NIM)

The list of peer reviewers was updated. A. Dunford (MSL) replaced T. Armstrong (MSL). S. E. Park (KRISS) and Y. Koyama (NICT) were removed.

The list of contacts for CMC reviews was checked. No changes were required.

The list of WG coordinators was checked. No changes were required.

The list of the TCTF members was checked and updated: T. Suzuyama was replaced by M. Yasuda (NMIJ).

G. Presentation on APMP GA 2020 (P. Phoonthong, NIMT)

A brief video presentation on Bangkok was given, and some details regarding the APMP 2020 GA were mentioned and discussed.

The proposed dates (circa end of October / beginning of November 2020) are close to the CCTF (ends 30 October).

The TCTF meeting for 2020 was closed at approximately 11 am.