



Sharing Resources to Improve the International Timekeeping

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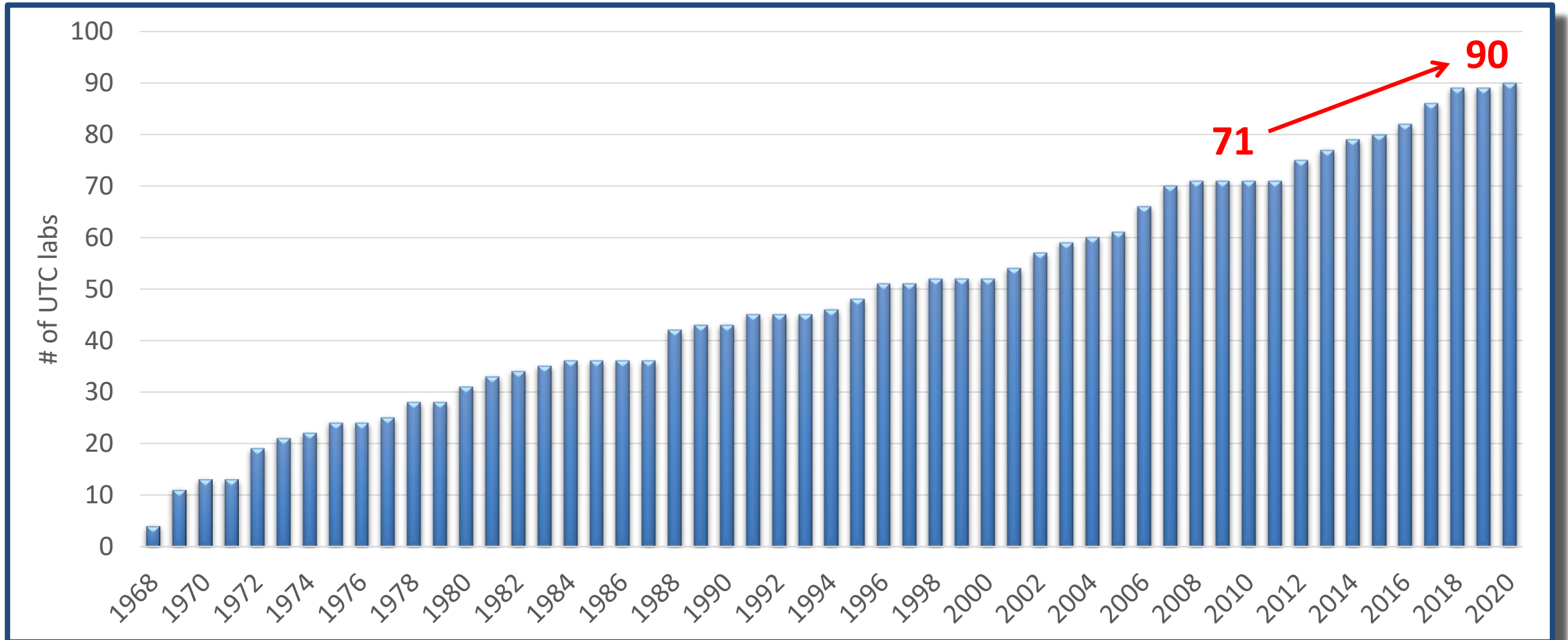
CONSULTATIVE COMMITTEE
FOR TIME AND FREQUENCY

CCTF 22-1, October 28-29, 2020

Outline

- UTC(k) community is growing
- more Training and Resources are required
- what can **we** do?
- how can **you** help?
- example: CBKT initiative in the TIME Department

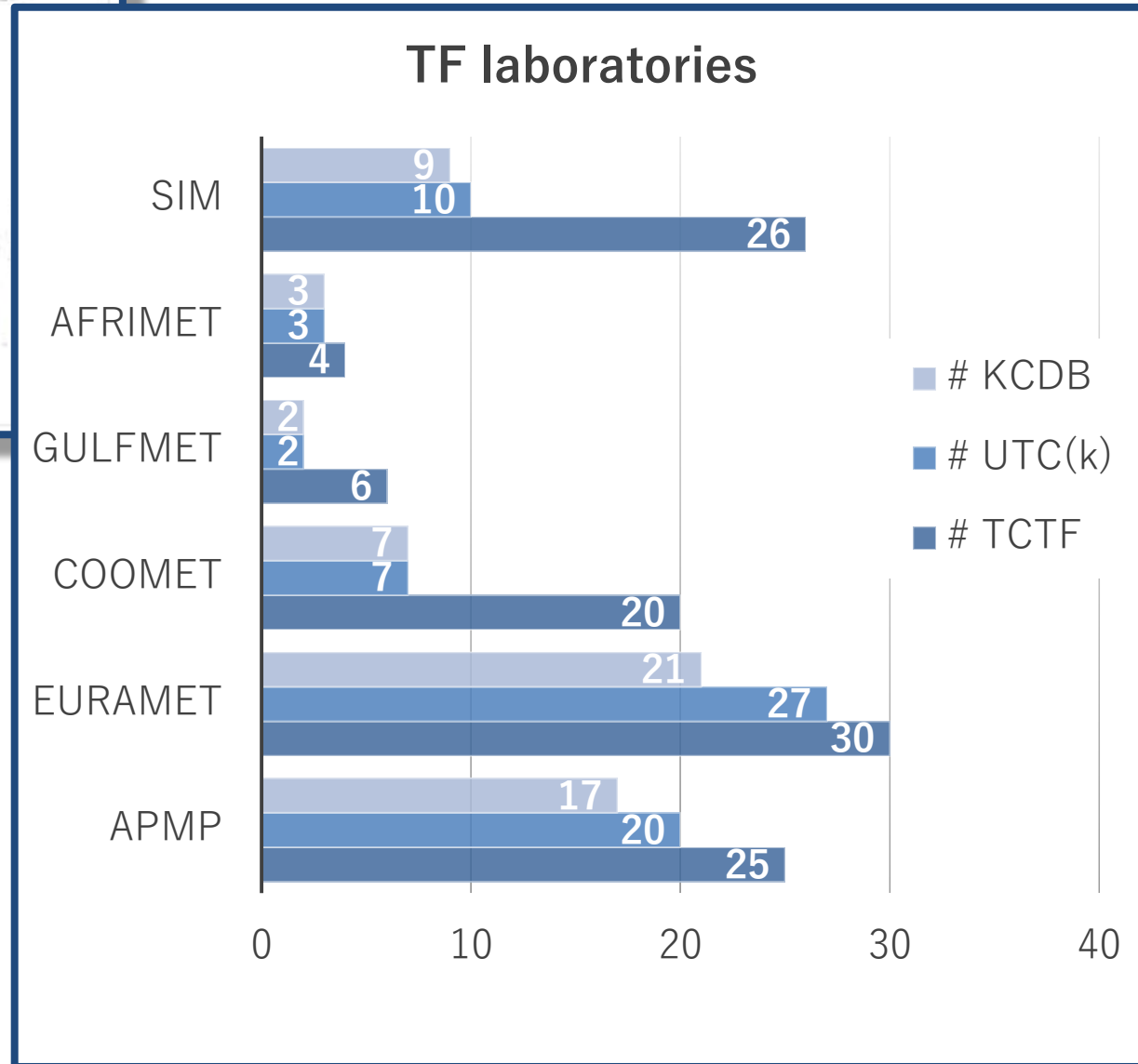
UTC(k) community is growing:



Time Labs



New labs are coming on board that will benefit from learning more about the best practices in setting up UTC(k)



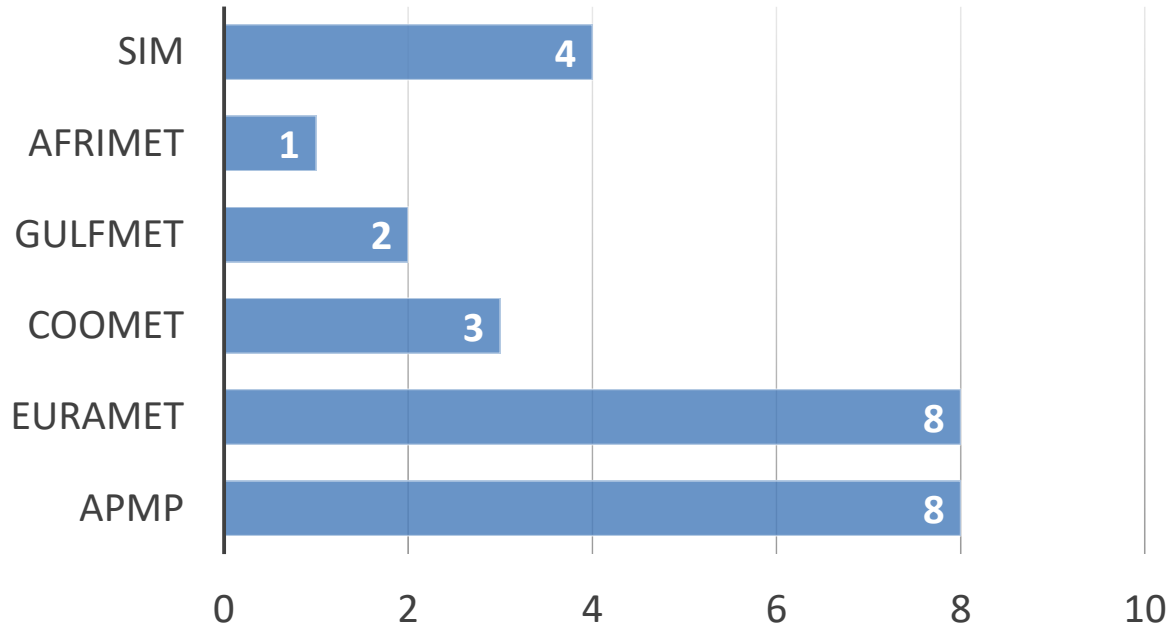
more Training and Resources are required:

- automatic UTC computation algorithms check for anomalies in submitted data (labs are contacted when problem investigation is required)
 - outliers
 - jumps / step direction
 - consistency with previous submission
 - gaps

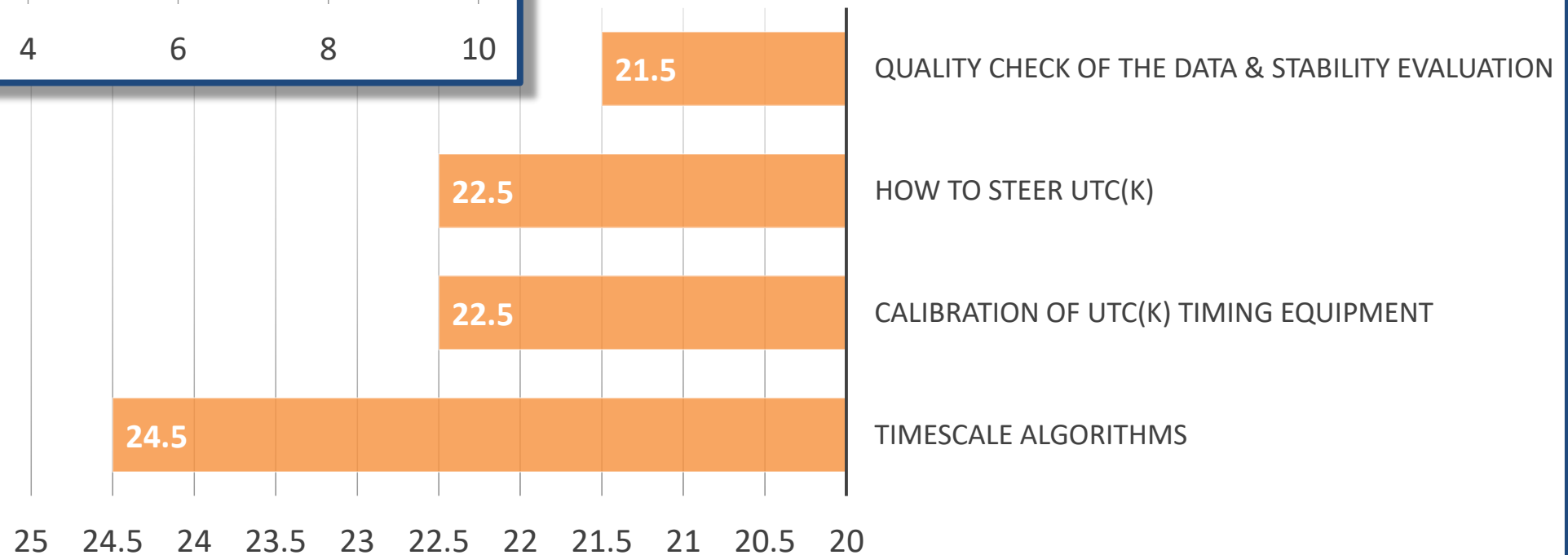
Goal: Support labs in developing methods for fast and efficient data diagnosis and problems identification

WG-ALGO & WG-TAI Survey (07/2019)

26 NMI responded



Topics of interest



what can we do?

training

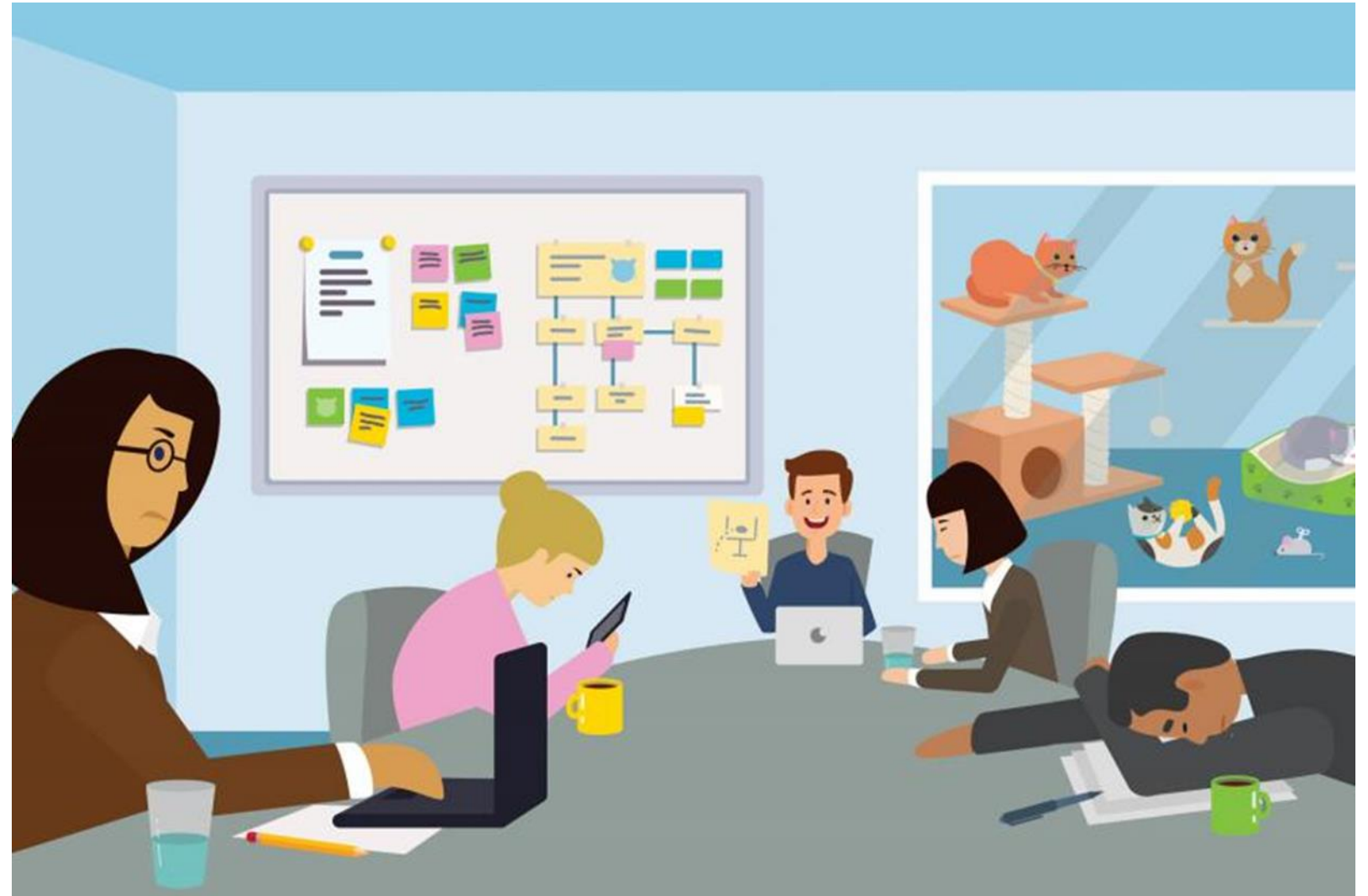
tools

resources \$\$\$

training

workshops/schools

- at RMO
 - TC meetings and WSs
- at BIPM
 - CBKT UTC training 2018
<https://www.bipm.org/en/news/full-stories/2018-03-cbkt-utc.html>
 - ALGO symposium 2015
<https://www.bipm.org/en/conference-centre/bipm-workshops/tsas/>
- at conferences
 - PTTI, IFCS, EFTF
- virtual
 - CBKT KCDB 2.0 training 2020
<https://www.bipm.org/en/news/full-stories/2020-06-virtual-cbkt.html>



training

secondment and apprenticeship

- at BIPM
 - secondment open for 2021-2022
https://www.bipm.org/utis/common/pdf/secondments/BIPM_Time.pdf
- at NMI

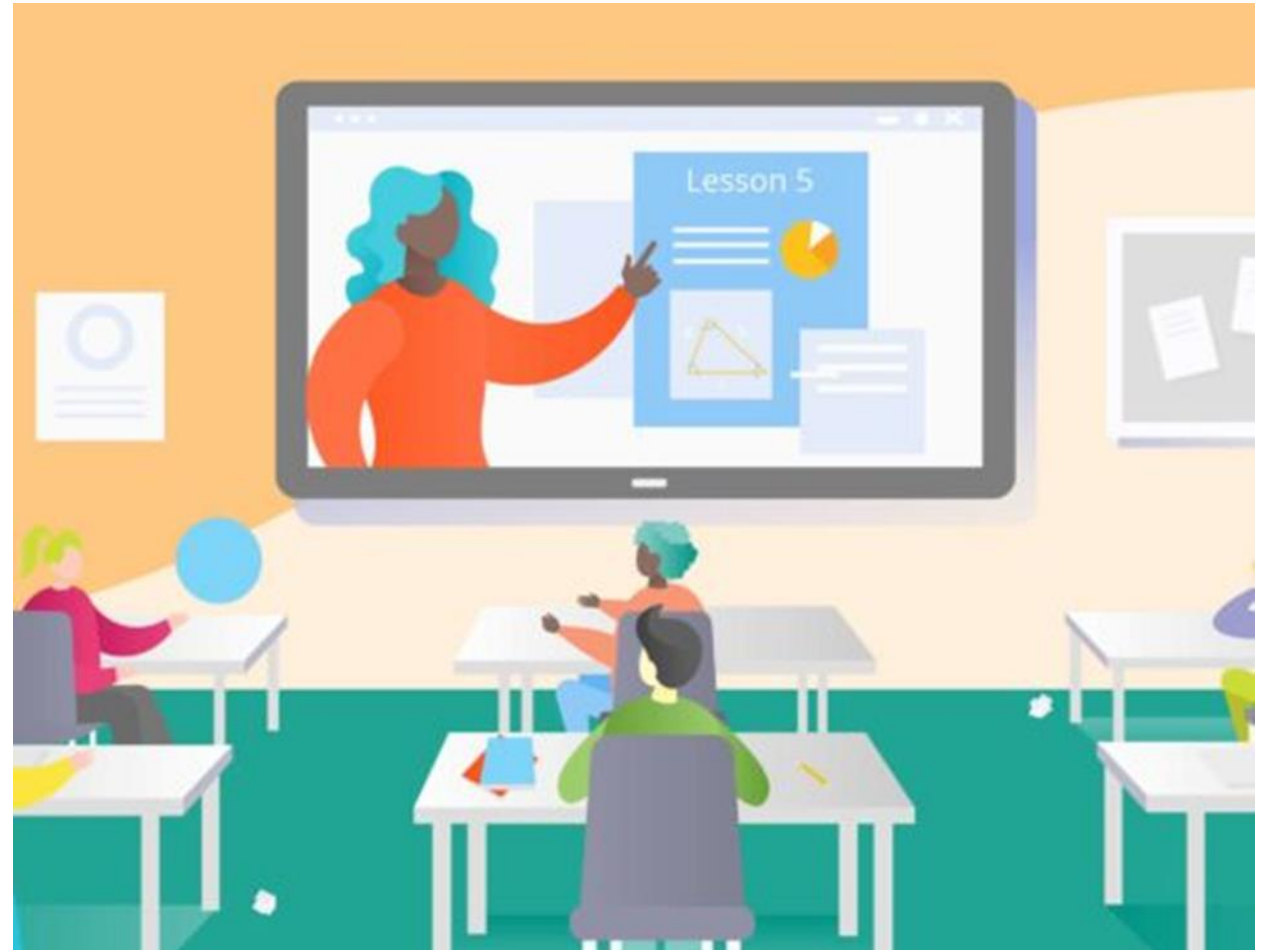


https://www.cae.net/wp-content/uploads/2018/02/shutterstock_597925112_web.png

tools

virtual training courses

- tutorials slides/videos
 - CBKT e-learning
 - **under development**
<https://www.bipm.org/en/news/full-stories/2020-05-cbkt-remote.html>



tools

information sharing

- forum
- equipment lists
- system diagrams and best practices

shared software tools

- data collection
- data monitoring
- data verification
- data analysis
 - allantools
<https://pypi.org/project/AllanTools/>
 - stable32
<https://ieee-uffc.org/frequency-control/frequency-control-software/stable32/>



resources & \$\$\$

granting agencies

- ...

NMI

- PTB, NIST, METAS

RMO

- ...

BIPM

- CBKT



what can we do?

training

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resources & \$\$\$

- granting agencies
 - ...
- NMI
 - PTB, NIST, METAS
- RMO
- BIPM CBKT
 - core activity ???
 - secure funding for training by BIPM staff (like MRA training)
 - continuity of service

how can you help?

— share your **expertise**

- present your systems/methods at WG-TAI meeting in March
- share printed & video material on CBKT
- contribute with theoretical and practical training

— share your **resources**

- invite junior metrologists for work visits in your labs
- share your software tools on CBKT to be used by the community
- donate/loan your spare equipment

— provide **feedback**

- send comments/questions to BIPM, WGs & NMIs via Forum on BIPM website
- participate actively in CMC reviews
- participate actively in WG TAI to share your experience and ideas

example : CBKT initiative in the TIME Department

<https://www.bipm.org/en/cbkt/>

- To assist individual NMI staff, NMIs and RMOs to increase their understanding and capability with regard to engagement in the world metrology system, with the aim of strengthening the capacity of the international metrology community to operate the world-wide measurement system on an equitable cost-shared basis;
- To embed metrology more effectively in wider quality infrastructure development initiatives.



CORE CAPACITY BUILDING (CB)

01

Covers areas that are vital importance to Member States and the BIPM, and of common interest to the global metrology community. Funded (or partly funded) by the BIPM dotation.

TOPIC-BASED CAPACITY BUILDING (CB)

02

Flexible to address topics of interest to specific groups of MS & Associates. Relies on external sponsorship, and topics are determined by the need, and upon the agreement of the sponsoring organization and the BIPM.

KNOWLEDGE TRANSFER (KT)

03

Take many forms, involving the BIPM staff, Visiting Scientists from NMIs/DIs, as well as groups of experts assembled from around the world. It also includes a wide range of other knowledge transfer activities defined by the BIPM.

CBKT initiative in the TIME Department

- In collaboration with RMO, BIPM launched the CBKT program:

*“Capacity **B**uilding and **K**nowledge **T**ransfer program”*

- most of current activities support MRA (e.g. KCDB 2.0 training course)
- first CBKT in time (**sponsored by METAS**) was the course given in Feb **2018**:
<https://www.bipm.org/en/news/full-stories/2018-03-cbkt-utc.html>

- BIPM Time Department is preparing the following CBKT activities:

1. Development of a course on time-scales and algorithms with tutorial lectures and training.

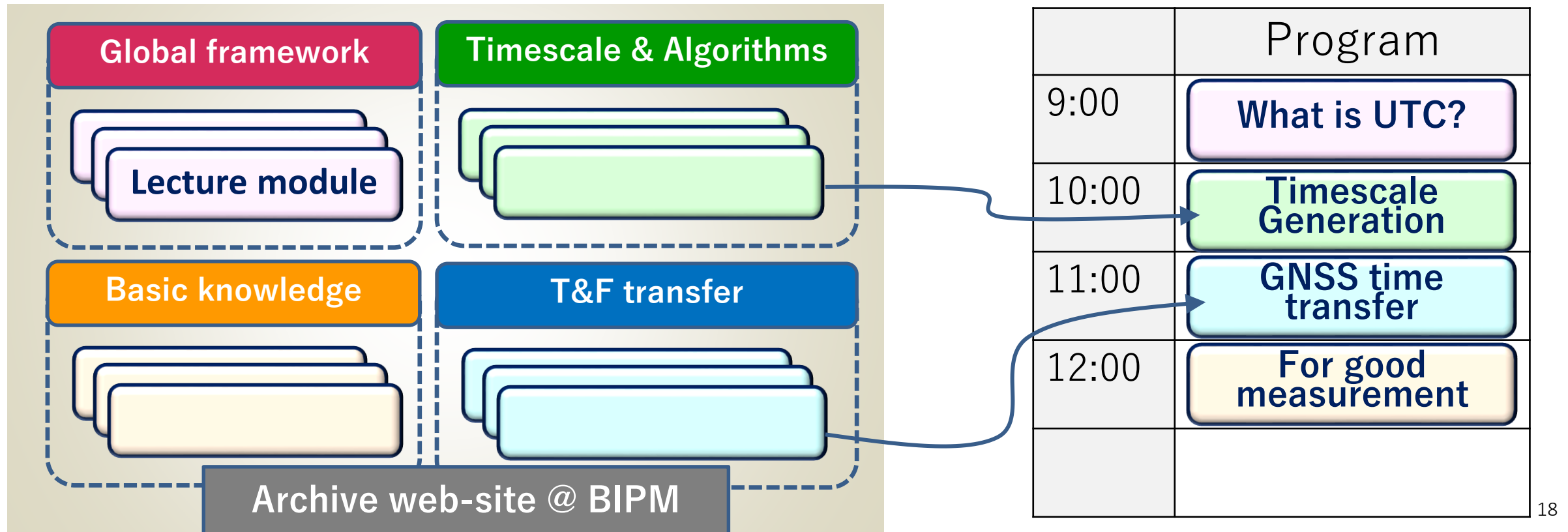
- It can be **delivered BIPM or at RMO** with the RMO lab support.
- The **targeted attendees** are **junior metrologists** who are/will be in charge of operating national standard time and participating in UTC.

2. Development of on-line tools:

- **Tutorial contents, simulation tools, and demonstration videos**
- These items will be **offered during the course**, and could be available for **on-line training** hosted on the BIPM web page.

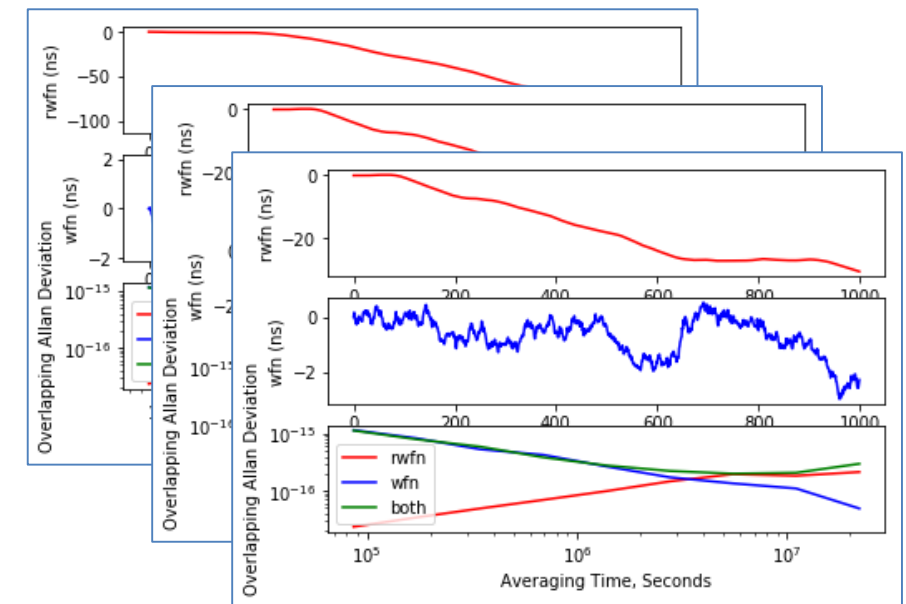
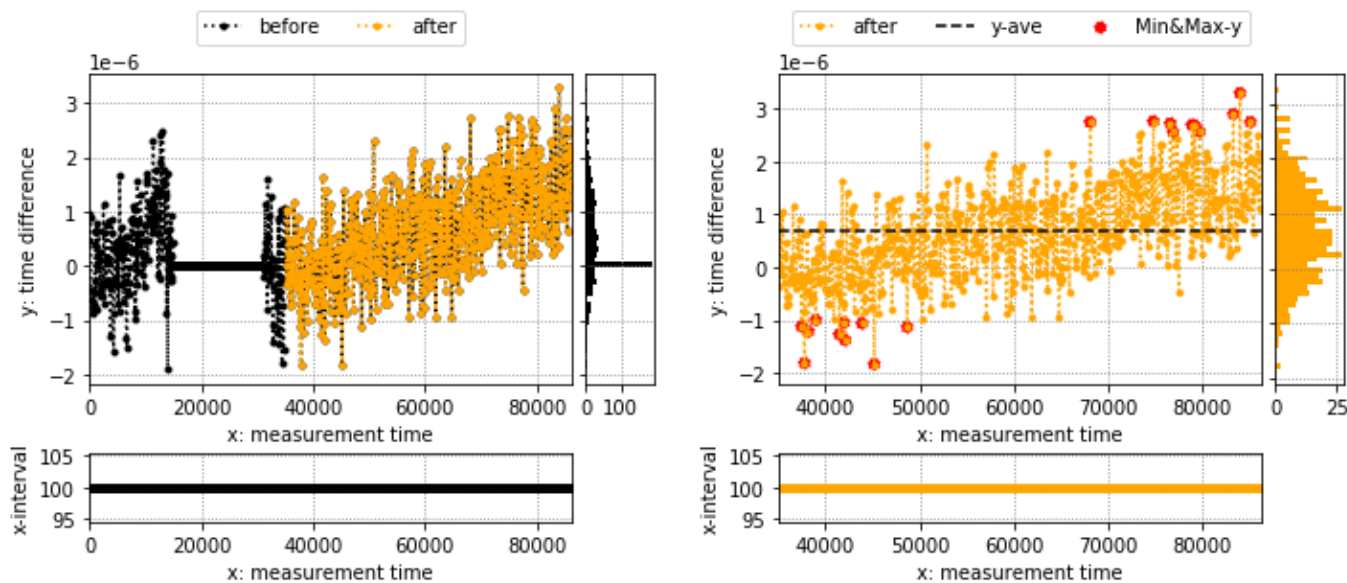
Contents for the training are archived at BIPM

- Tutorial lecture modules (voluntarily shared by experts) will be archived at BIPM web-site. These modules can be used in a training program according to its purpose.



Software for practical exercise

- Practical exercise for generating a timescale is going to be prepared.
Data processing tool & time scale simulator by Python code
- This software is open source and will be delivered to the trainees.



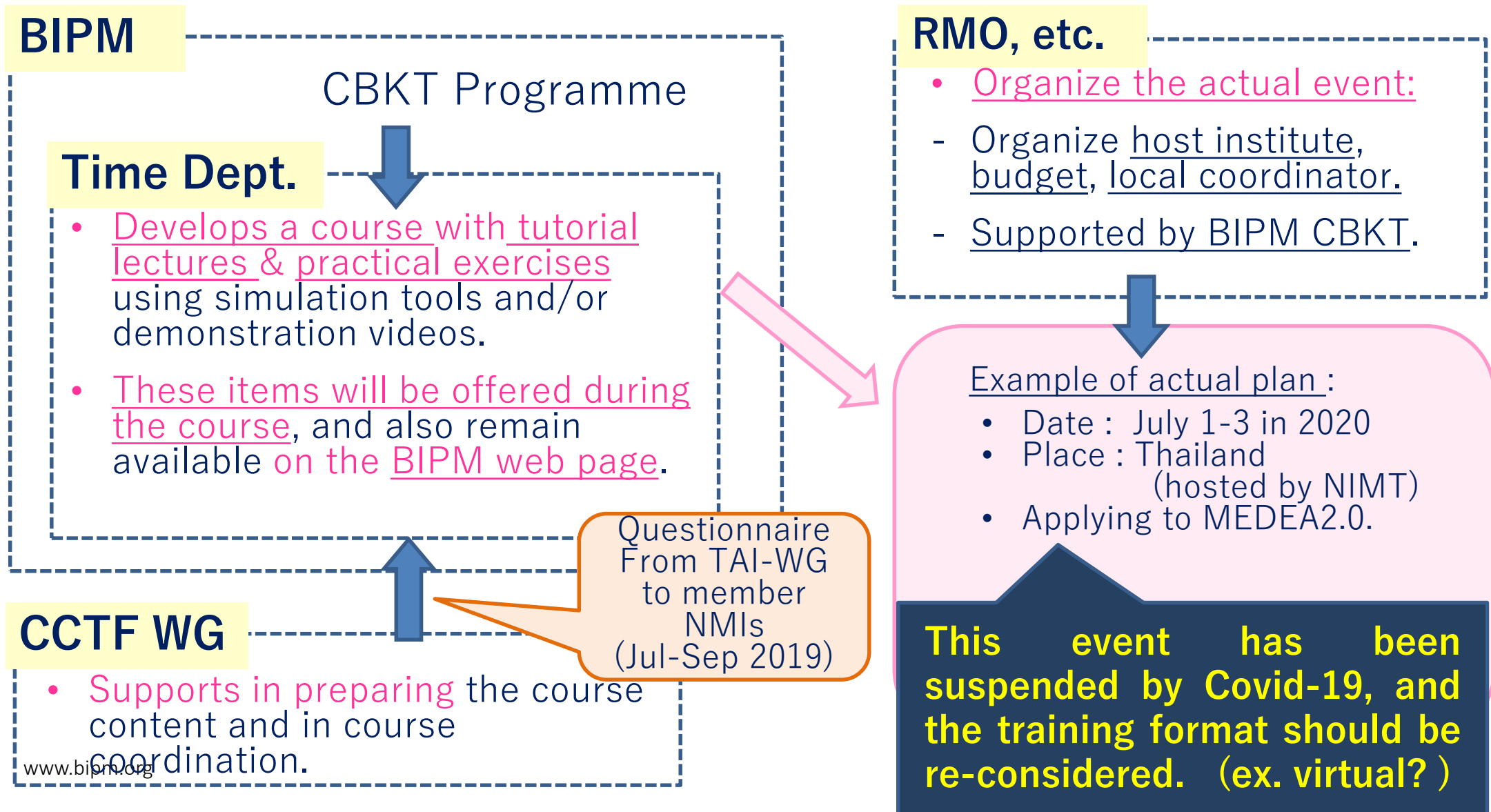
Data processing tool (bad data elimination, linear fitting etc.)

Time scale simulator by using the virtual clock

What will be learned and achieved

- Basic knowledge and overview of time scale generation, comparisons, algorithms for performance evaluation, and participation in UTC.
- Better insight and some practical skills on GNSS measurements, calibration, clock data analysis, time scale generation and steering.
- Simple example of self-developed software code.
- Introduction to freeware software tools available for public download (allantools, ...).
- Stronger engagement with the BIPM Time Dept and the other RMO Time labs supporting further collaborations and joint projects.

Training program collaborative structure



Is your NMI interested in hosting (and funding) such training course?

Is your lab interested in collaborating and taking advantage of these initiatives?

questions for CCTF 22-2 (March 2021)

- Is your laboratory a **Mentor** or a **Mentee**?
- Are you **interested** in these capacity building activities and will they **benefit** your team members?
- Do you have **software tools** (clock monitoring/data analysis/data submission automation) you can **share** with the community?
- Can you **host a colleague** for training?
- Can you **host a training workshop**?
 - for and in collaboration with RMO TCTF
- Can you support (**fund**) **training** for your team members at workshops, other labs or BIPM?
- Can you **sponsor** training for other labs?
- Can you provide **tutorial material** for virtual training?
- Can you support (**fund**) your team members **to give training** at workshops?
- Do you **support** the initiative to make **UTC(k) training a BIPM CBKT core activity** funded by CGPM in 2022?
 - Will you approach your NMI Director to **lobby** for that?
 - Can you support (**fund**) your team member as a secondee at BIPM to develop the e-learning program with CBKT?

Thank you

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