



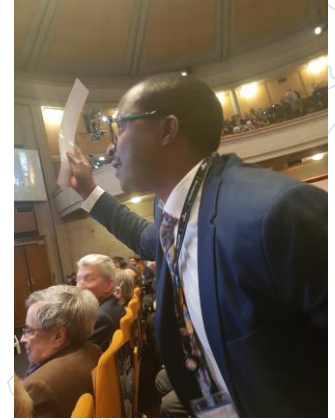
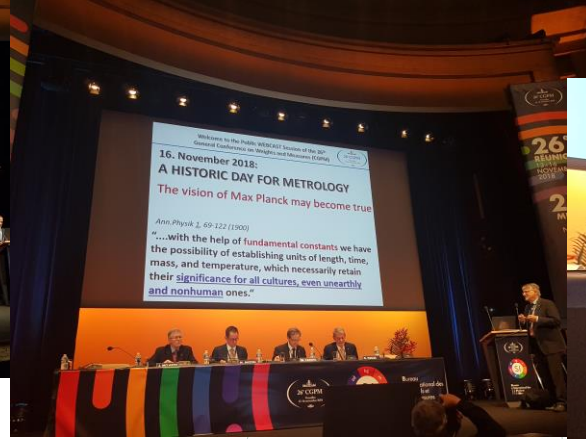
The CIPM Strategy 2030+

Bureau
International des
Poids et
Mesures

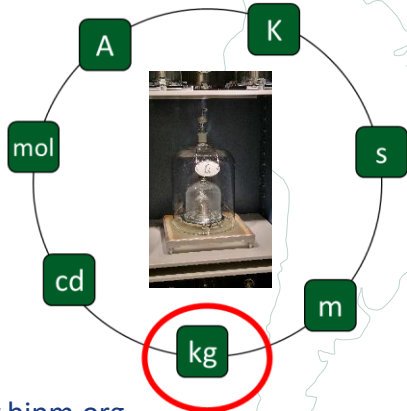
Wynand Louw
President CIPM

Survey Slides Provided by Rahima Guliyeva

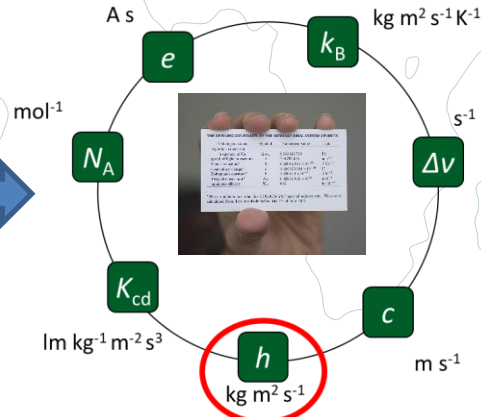
16 November 2018



Current SI (unit based)



Revised SI (constant based)



Work plan for Strategy 2024 (and 2030+)

1. Responding to Evolving Needs for Metrology
2. Addressing key scientific challenges to advance the global measurement system
3. Strategy for deepening engagement with other international organisations on measurement science issues
4. Reviewing the strategy for Universal Adherence to the Metre Convention
5. Modernising the operations of the organisation

Work plan for Strategy 2024 (and 2030+)

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CIPM Strategy 2030+

21st Century Metrology Grand Challenges

The CIPM identified five “Metrology Grand Challenges”:

- Climate change and environment
- Health & life sciences
- Food safety
- Energy
- Advanced manufacturing



Next to cross-cutting challenges related to *how* we make measurements:

- Digital Transformation
- “New” metrology (e.g. sensor networks, NMI-on-a-chip)



„Horizontal Groups“



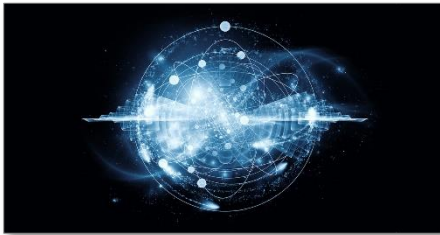
Sectorial Task Group on Climate and Environment

- Workshop with WMO 26-30 September, 2022: report available
- First time in 2023: Participation in COP 28 as observer
- 1st Stakeholder meeting of the CIPM Sectorial Task Group on Climate Change and Environment: 16/18 September 2024



Forum on Metrology and Digitalization

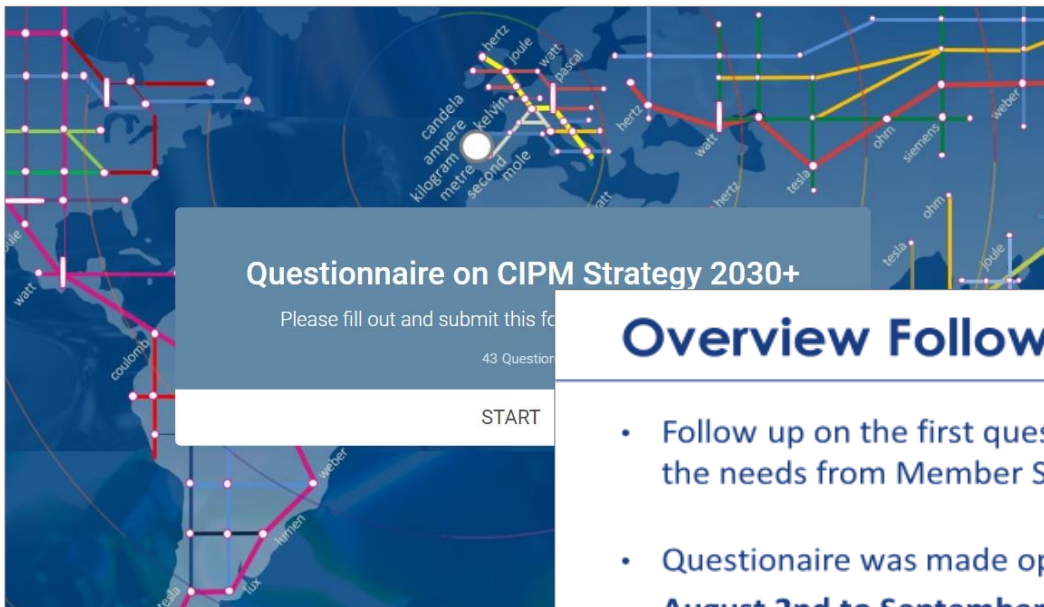
- Kick-off Meeting: 21 November, 2022
- Workshop on FAIR Data: 05/06 March, 2024
- First Forum Meeting: 07/08 March, 2024



Quantum Technologies

- First workshop: 22/23 March, 2024
- Proposal for nmi^Q
- CIPM QuTG

CIPM Strategy 2030+

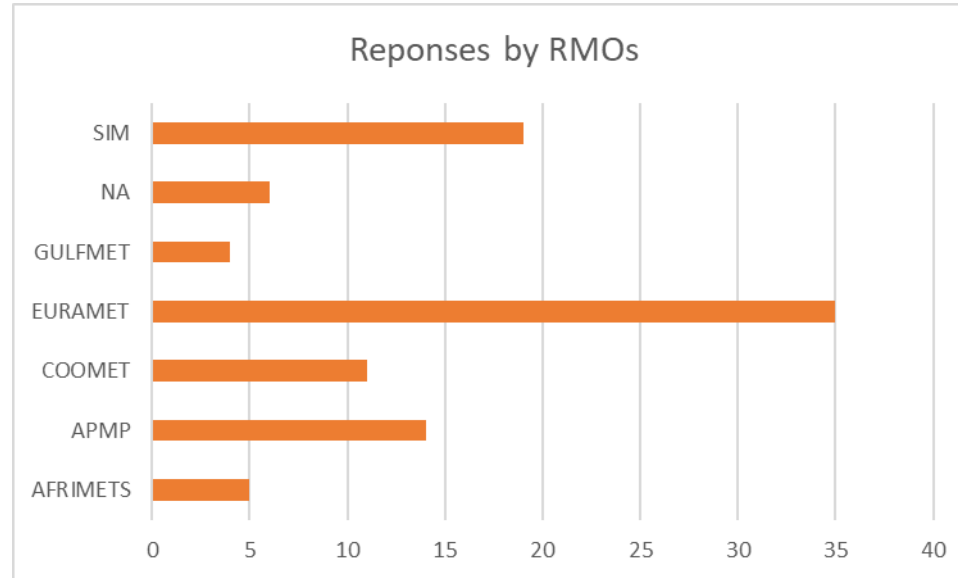


Overview Follow-up Questionnaire

- Follow up on the first questionnaire (April 2023) to prioritize the needs from Member States on the future role of CIPM
- Questionnaire was made openly available from **August 2nd to September 8th (approx. 5 weeks)**
- E-mails were sent to NMI directors, State Representatives of Member States (approx. 200 people)

Respondents

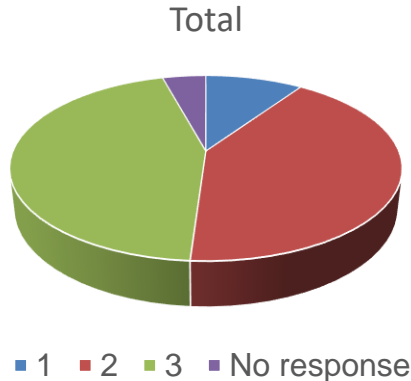
- ◆ 94 responses from 43 countries (including 3 IOs and 1 RMO)
- ◆ Different level of participation from the different regions



Analysis on the questionnaire for Part 1 (included in CIPM report)

- Climate change

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Atmospheric composition including GHG
 - . Development of RM for gas mixtures
 - . Carbon capture and decarbonization
 - . Horizon Europe projects, etc.



42 out of 94 already have programmes

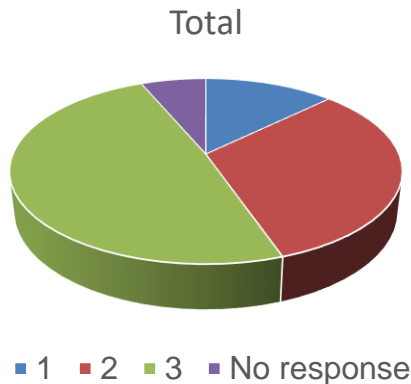
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- Health

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Development of new methods or equipment
 - . CRM for laboratory medicine
 - . Traceability for medical devices
 - . Digital health, water treatment, etc.



46 out of 94 already have programmes

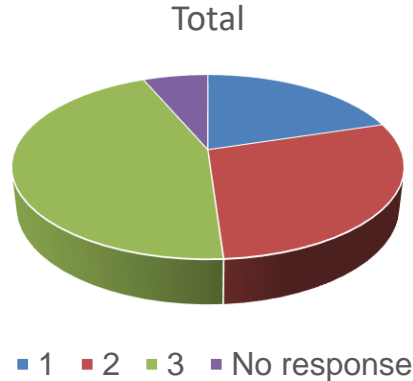
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- Food safety

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Development of RM including toxic elements, GMOs, nano plastics
 - . Microbiological tests



42 out of 94 already have programmes

*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

CCQM Task Group on Food Measurement formed following 2023 NMI Directors' meeting



CCQM Task Group on Food Measurement (CCQM-TG-FOOD)

Working Groups

Select

View

Chair

Dr Jeremy Melanson

Director of R&D
National Research Council of Canada
Canada

Secretary

Dr Ralf Josephs

Bureau international des poids et mesures
France

ALL MEMBERS

Date Established: February 2024

Status: Active

Terms of Reference

The Task Group is being established in response to the CIPM initiative to outline evolving needs for metrology in major challenge areas for society including food safety and its reliance on food measurement.



CCQM Task Group on Food Measurement

Meetings and related documents

UPCOMING MEETING

CCQM Virtual
Stakeholder Workshop of
the TG-FOOD

FROM 10 TO 13
FEBRUARY
2025

 RALF JOSEPHS  CCQM-TG-FOOD

PAST MEETING

CCQM-TG-FOOD

16
APRIL
2024

 RALF JOSEPHS  CCQM-TG-FOOD

PAST MEETING

CCQM-TG-FOOD

06
FEBRUARY
2024

 RALF JOSEPHS  CCQM-TG-FOOD

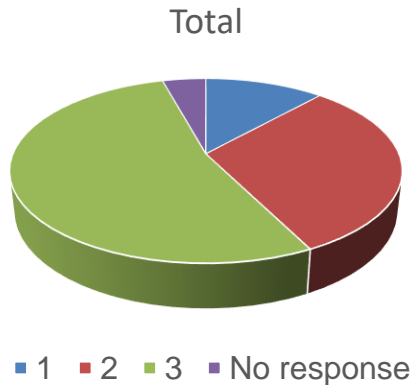
**Working with CCRI,
CCPR, CCM, CCT for
2025 Stakeholder
meeting**

- To liaise with other CCs and identify measurements related to food and food safety covered by activities in these communities that could be incorporated into broader document covering food measurements issues and needs including those outside chemical and biological measurements.

Analysis on the questionnaire for Part 1

- Energy

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Renewable energy, energy storage, smart electrical grids
 - . Energy saving technology
 - . Electrical mobility including battery



50 out of 94 already have programmes

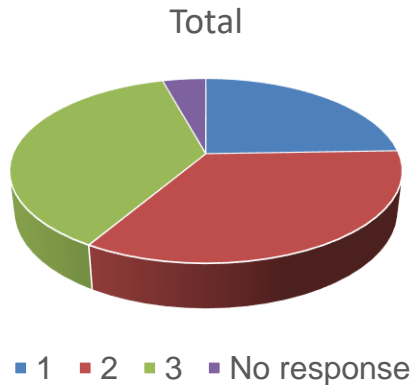
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- Advanced Manufacturing

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Additive manufacturing
 - . Tomography metrology
 - . Chip technologies covering semiconductor, robotics



35 out of 94 already have programmes

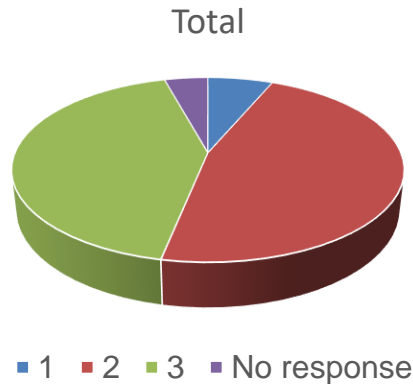
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- Digital Transformation

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . DCC including remote / real-time / online / virtual calibration
 - . Bid data science
 - . Linking AI technology to DCC



40 out of 94 already have programmes

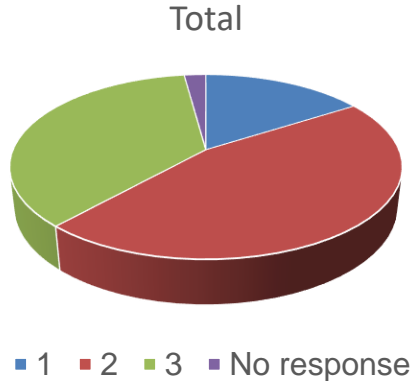
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- New metrology

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Programmes for AI
 - . Self-referenced standard
 - . Embedded measurement, Intrinsic standards



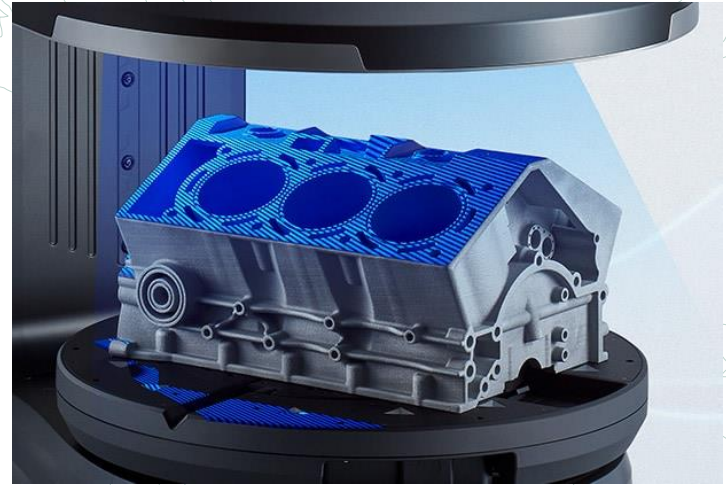
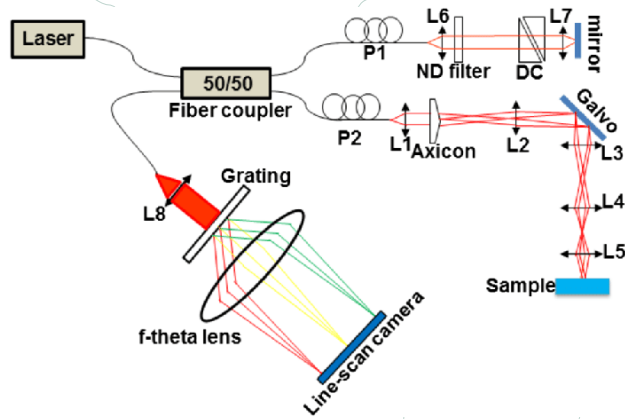
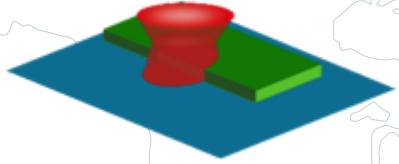
34 out of 94 already have programmes, **43** feel the necessity

*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Nano-scale precision measurement with structured light

Using structured light we will establish accurate laser profilometry for characterisation of surface roughness and thickness, to nanometre precision

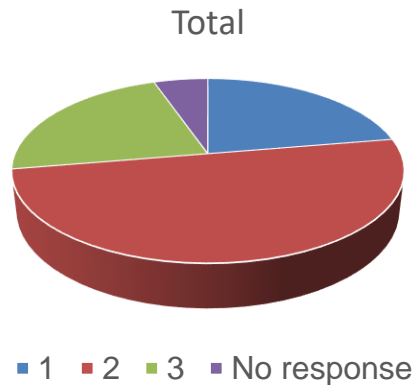


<https://www.researchgate.net/profile/Duc-Huy-Nguyen-2/publication/259607872/figure/fig2/AS:601743784161280@1520478306078/Schematic-of-the-ultrahigh-resolution-optical-coherence-microscopy-UHR-OCM-system-L1.png>

Analysis on the questionnaire for Part 1

- Sensor networks

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Optical fiber
 - . Low cost sensor system
 - . Smart network metrology including cybersecurity, environment



21 out of 94 already have programmes, **47** feel the necessity

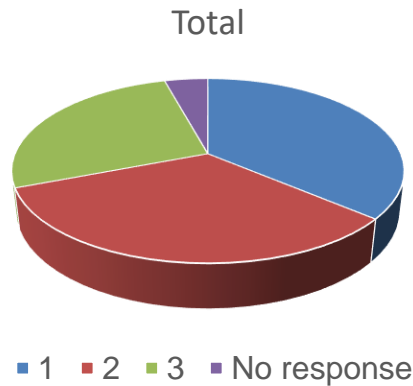
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- AI

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Development of algorithms for AI and ML
 - . Assessment of AI system
 - . Development of Hardware for AI
 - . Validation of training data for AI



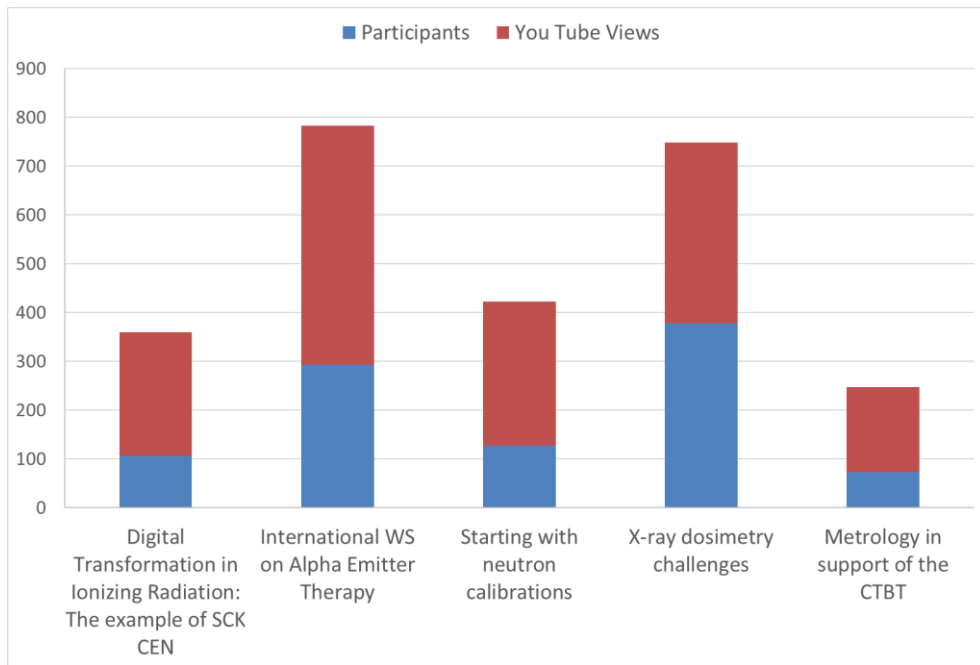
25 out of 94 already have programmes

*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

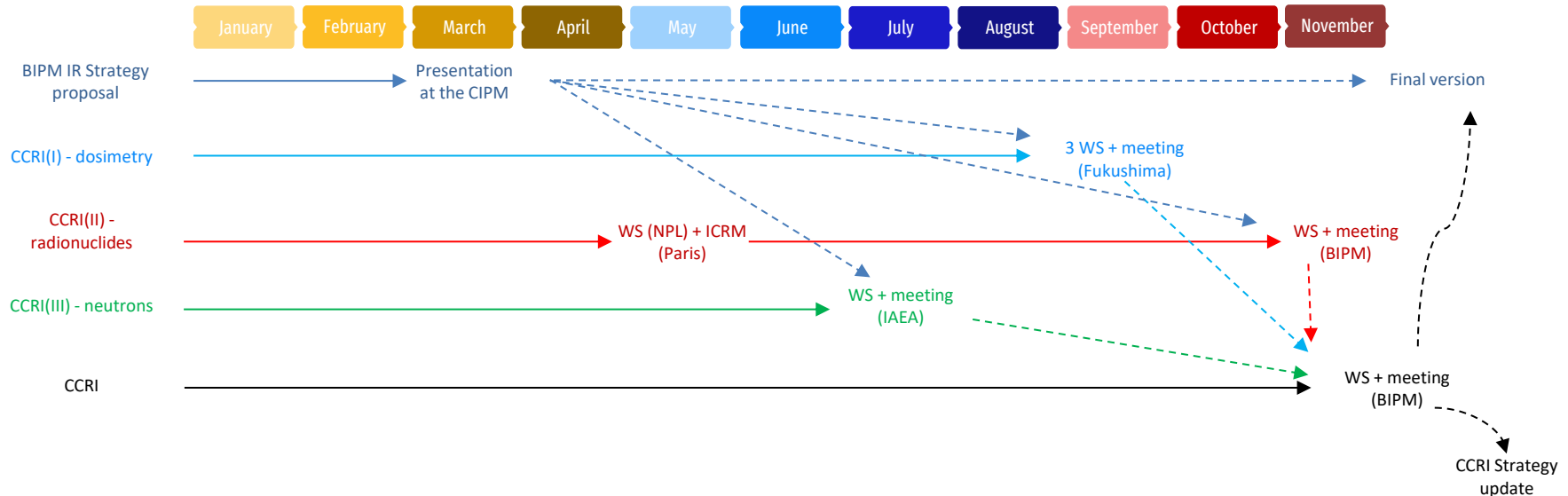
Ionising Radiation: Webinars 2024

- ❑ **8 webinars in 2024 (5 held and 3 planned for the next months)**
 - 1000 participants (from 100 to 300 per session) and 1600 YouTube views (200 to 500)
 - Including one workshop (alpha therapy) held at the BIPM (60 participants on site)



Building long term strategy

- **2025 – 150 years anniversary of the BIPM and 65 years anniversary of the BIPM IR Department**
 - Time to build a long-term vision for IR department together with the update of the CCRI strategy



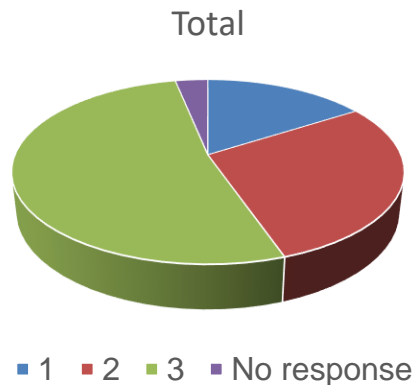
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Analysis on the questionnaire for Part 1

- Realisation of new SI

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . New calibration services based on the revised SI
 - . Continued involvement in mass realisation (Kibble balance)
 - . Implementing quantum standards (QHR, JAVS, quantum multimeter)

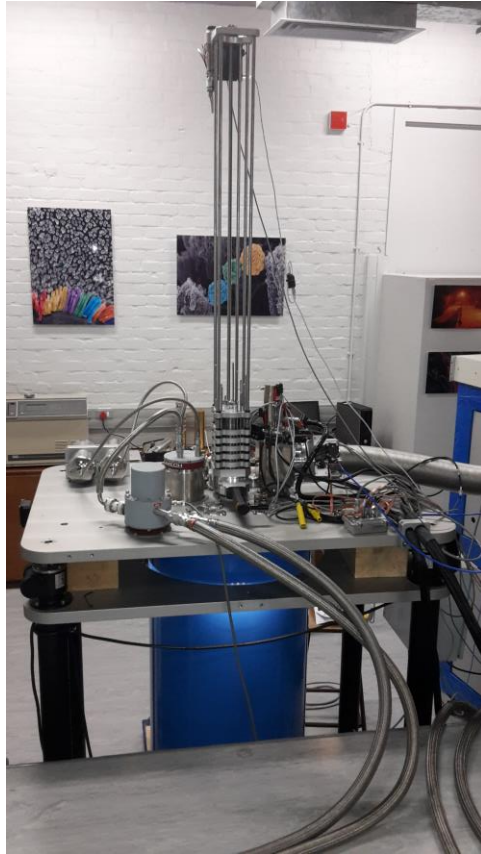


49 out of 94 already have programmes

*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

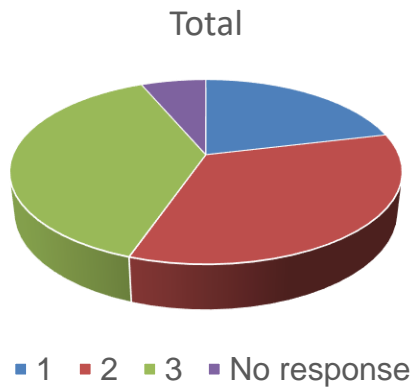
Ampere: Single Electron Counting



Analysis on the questionnaire for Part 1

- Redefinition of second

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Transportable/Portable optical clock
 - . Optical atomic clock & Optical lattice clock



36 out of 94 already have programmes

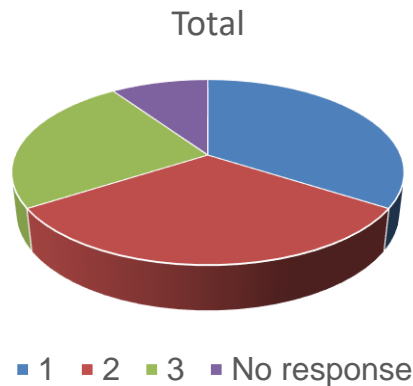
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 1

- Redefinition of candela

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . EMPIR 19NRM02RevStdLED project
 - . Primary optical power realisation



23 out of 94 already have programmes

*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes



Workshop on the Future of the Candela

Half-day Tuesday

What is the
Annette Ko

CCU intere
Richard Br

No changes
Arming Sp

Adopt Con
Yoshi Ohnc

Bring photo
value for ex
Gael Obeir

A qu
ques

Considering implementation of cone-fundamental-based spectral luminous efficiency functions

In the current SI, the candela is defined with a fixed defining constant, K_{cd} (683 lm/W), without reference to any spectral luminous efficiency functions. Thus, only changing the $V(\lambda)$ would not require revision of the candela definition in the SI.

However, changing the $V(\lambda)$ would result in change of photometric values of real lighting sources.

Such changes of photometric values (like lumen rating of lamps) could be a serious problem for the industry and market

Approach

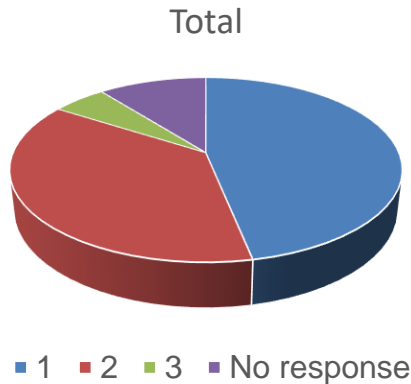
- (1) Revising the value of K_{cd}
- (2) Re-scaling the $V_F(\lambda)$, $V_{F10}(\lambda)$ functions
- (3) Correction factor

(2) will not be a viable option because there is a convention in CIE/CIPM that all action spectra (including spectral luminous efficiency functions) must be normalized to 1 at peak.

Analysis on the questionnaire for Part 2

- Block chain

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Security guarantees, cryptographic mechanism
 - . Record management, data securities



10 out of 94 already have programmes

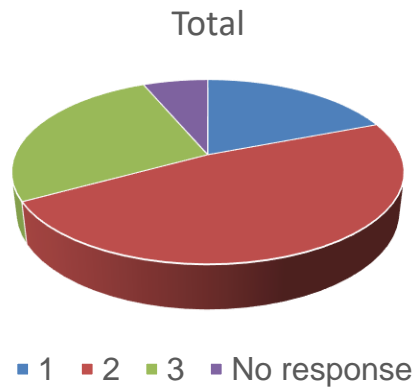
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 2

- Fair data

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Platform establishment for Fair data
 - . Quality assured research data management



25 out of 94 already have programmes, **45** feel the necessity

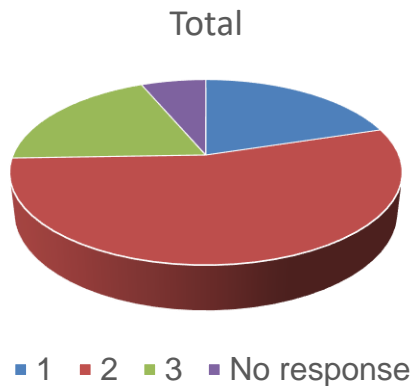
*Explanation

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2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 2

- Open Science

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Open access for research, CRM information
 - . Infrastructure for open data, software data base, open source code, publications



18 out of 94 already have programmes, **51** feel the necessity

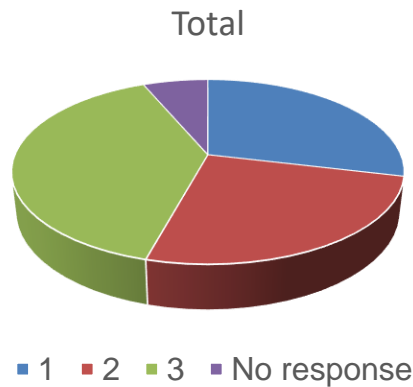
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 2

- Quantum Technology

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Quantum sensors and measurement devices
 - . Super conducting quantum computer
 - . Quantum communications



37 out of 94 already have programmes,

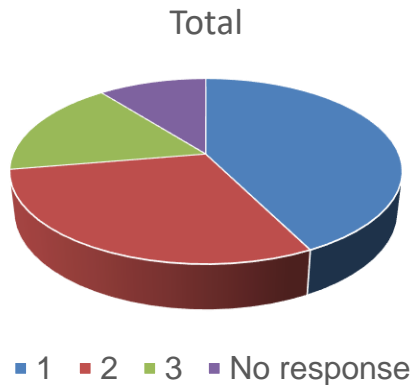
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 2

- Precision medicine

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . RM for personalised medicine
 - . Big data medical diagnosis
 - . Organ on chip



16 out of 94 already have programmes,

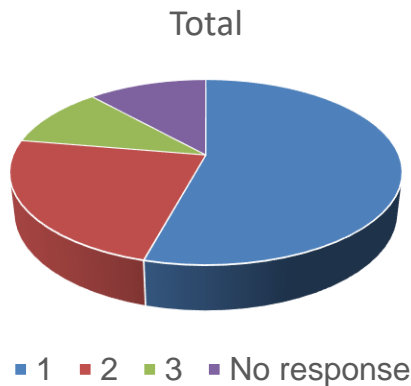
*Explanation

1. No plans
2. Identified the needs, but no programme
3. Already have programmes

Analysis on the questionnaire for Part 2

- Bio manufacturing

- ◆ Findings according to respective area
 - Comments from who already have programmes
 - . Low cost drugs
 - . Advanced biomanufacturing standards



10 out of 94 already have programmes,

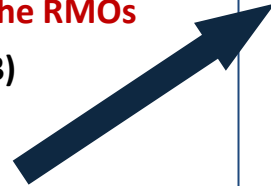
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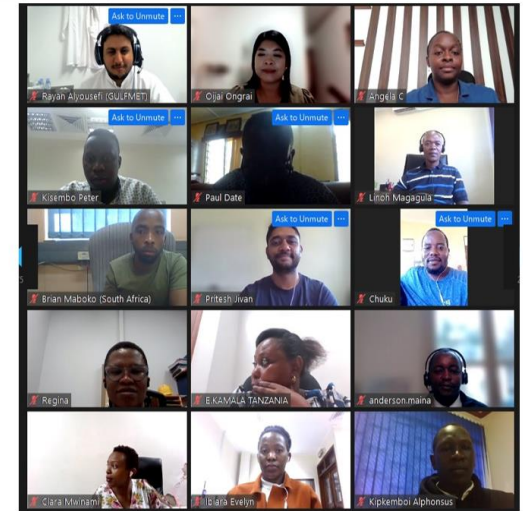
Young metrologists' 2050+ vision

Where do “young metrologists” think metrology will be in 2050+?

- ✓ **To complement the CIPM Strategy 2030+**
 - ✓ **Foresight exercise in collaboration with the RMOs**
1. RMO Coordinators nominated (**March 2023**)
 2. Online questionnaire launched (**July 2023**)
 3. Six RMO virtual workshops:
 4. RMO internal encouragement events are being held
 5. Consolidation workshop (in-person) with RMO Coordinators at BIPM HQ (**July 2024**)
 6. The draft will be reported at the October CIPM and NMI Directors meeting (**October 2024**)



YM2050+ _AFRIMETS workshop
(06.03.2024) – 78 participants



www.bipm.org

<https://www.bipm.org/en/committees/cb/cbkt/ym-2050>

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Signing the Joint Statement



ISO



CIPM



ISC



CODATA



CIE



IEC



ILAC



IMEKO

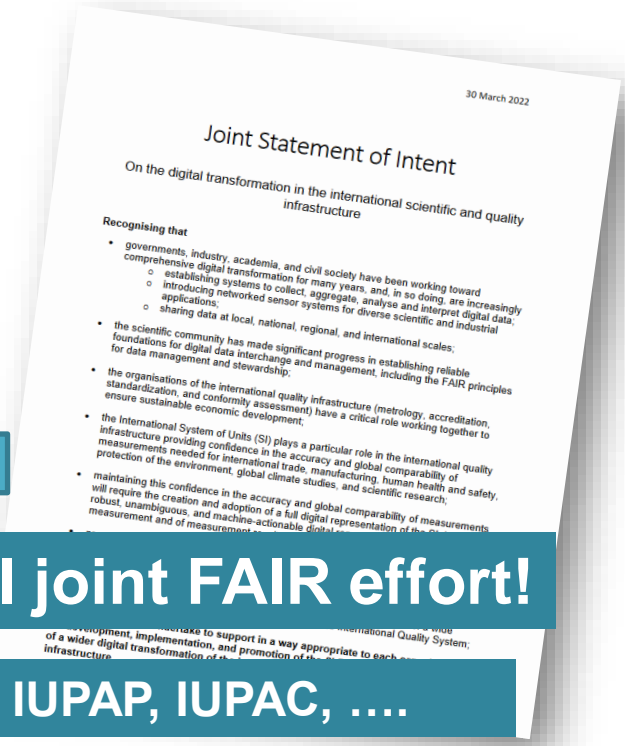


OIML

NCSLI

... a QI joint FAIR effort!

+ IUPAP, IUPAC,



<https://www.bipm.org/en/-/2022-03-30-digital-statement>

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Thank you

