




# Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology

Sang-Ryoul Park, CCQM President

November 2022



Working together to  
promote and advance  
the global comparability  
of measurements

# CCQM: Organizational Structure since April 2019

President: S-R. Park, CIPM

Executive Secretary: R. Wielgosz (BIPM)

## Working Groups :

- Organic Analysis (OAWG)
- Gas Analysis (GAWG)
- Inorganic Analysis (IAWG)
- Electrochemical Analysis (EAWG)
- Cellular Analysis (CAWG)
- Protein Analysis (PAWG)
- Nucleic Acids Analysis (NAWG)
- Surface Analysis (SAWG)
- Isotope Ratio Metrology (IRWG)
- Key Comparison and CMC Quality (KCWG)
- Strategic Planning (SPWG)
- ad hoc working group on the mole

## WG Chair

L. Mackay	NMIA
P. Brewer	NPL
M. Winchester	NIST
S. Seitz	PTB
J. Campbell	LGC
J. Melanson	NRC
J. Huggett	LGC
T. Fujimoto	NMIJ
Z. Mester	NRC
W.M.(Della) Sin	GLHK
S-R. Park	CIPM
B. Guettler	PTB

## Deputy Chair

K. Lippa	NIST
S. Lee	KRISS
P. Fisicaro	LNE
T. Asakai	NMIJ
Boqiang Fu	NIM
C. Swart	PTB
M. Vonsky	VNIIM
A. Shard	NPL
J. Vogl	BAM
A. Botha	NMISA

# CCQM Vision and Mission Statements

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**Approved by CCQM, August 2020:**

**The CCQM's vision:** A world in which all chemical and biological measurements are made at the required level of accuracy to meet the needs of society.

**The mission of the CCQM is:** To advance global comparability of chemical and biological measurement standards and capabilities, enabling Member states and Associates to make measurements with confidence.

# CCQM 2021-2030: Strategic Aims

## 7 Strategic Aims for 2021-2030 approved by CCQM, August 2020:

- 1) To contribute to the resolution of global challenges
- 2) To promote the uptake of metrologically traceable chemical and biological measurements
- 3) To progress the state of the art of chemical and biological measurement science
- 4) To improve efficiency and efficacy of the global system of comparisons for chemical and biological measurement standards conducted by the CCQM
- 5) To continue the evolution of CMCs to meet stakeholders' needs
- 6) To support the development of capabilities at NMIs and DIs with emerging activities
- 7) To maintain organizational vitality, regularly review and, if required, update the CCQM structure for it to be able to undertake its mission and best respond to the evolution of global measurement needs

# CCQM 2021-2030 Strategy: Published 21 June 2021



## CCQM STRATEGY DOCUMENT 2021-2030

Version 1.0 21.06.2021

### Plans for each Technical WG available

Sector	CCQM OAWG	CCQM PAWG	CCQM NAWG	CCQM CAWG	CCQM SAWG	CCQM EAWG	CCQM IAWG	CCQM IRWG	CCQM GAWG
Climate & Environment	POPs Contaminants Microplastics Water/Soil		Species/ microbial surveillance			Seawater pH and salinity	Heavy Metal Contaminants Speciation Water/Soil	GHGs	GHGs Air Quality Emissions Particles
Health & Life Sciences	Diagnostic biomarkers Forensics Anti-doping	Diagnostic biomarkers  Therapeutics	Diagnostic biomarkers  Gene Therapy	Diagnostic biomarkers	Imaging diagnostics Biocompatibility In-vitro diagnostic devices	Diagnostic biomarkers	Diagnostic biomarkers  Toxic Elements	Diagnostic biomarkers Forensics Anti-doping	Breath diagnostics
Food Safety	Toxins Contaminants Residues Authentication	Allergens Authentication	GMO-Foods Pathogens	Pathogens	Packaging materials		Heavy metal Contaminants Speciation	Food authentication	
Energy					Batteries Fuel/Solar cells Catalysts	Batteries Fuel Cells	Fuel Contaminants		Natural Gas LPG/LNG Hydrogen Biofuels
Advanced Manufacturing		Advanced Therapy Development	Biotechnology	Advanced Therapy Development	Nanotechnology Semiconductors Quantum devices	Nanotechnology	Nanotechnology		Trace Gases
Digitalization				Digital Pathology				Isotope Ratio Scale defining RMs Database	GHG Scales Database & Management



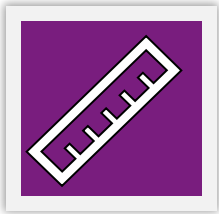
### Mapping out of Sector Specific activities



# CCQM Task Group on Stakeholder Engagement



To develop a document describing strategic and operational aspects for external stakeholder engagement



To use the strategy to document a mid- to long-term plan for CCQM's stakeholder engagement



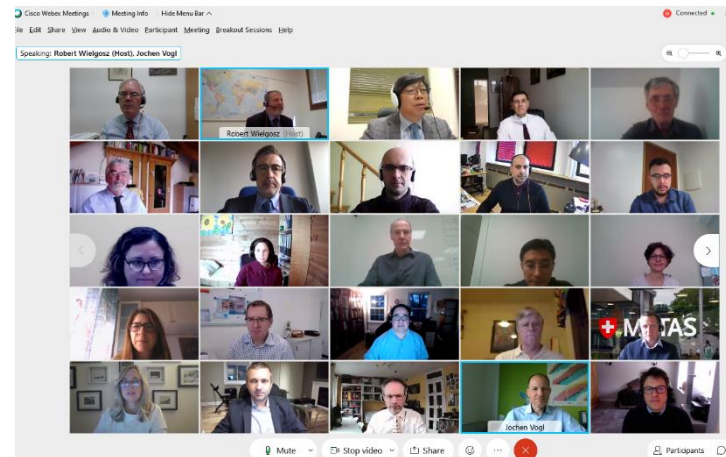
# CCQM activities progressed Online (2020-2022)

## CCQM Plenary Sessions:

- 11-12 April 2019
- 26-28 April 2021 (online)
- 27-29 April 2022 (online)

## CCQM WG Meetings (online):

- 73 in 2020
- 77 in 2021
- 44 in 2022



**Day 1: Strategy and Advances in Science**

**Day 2: WG Reports and Committee Activities**

**Day 3: Stakeholder Engagement, Sector focus: Environment and Climate (2022)** 7

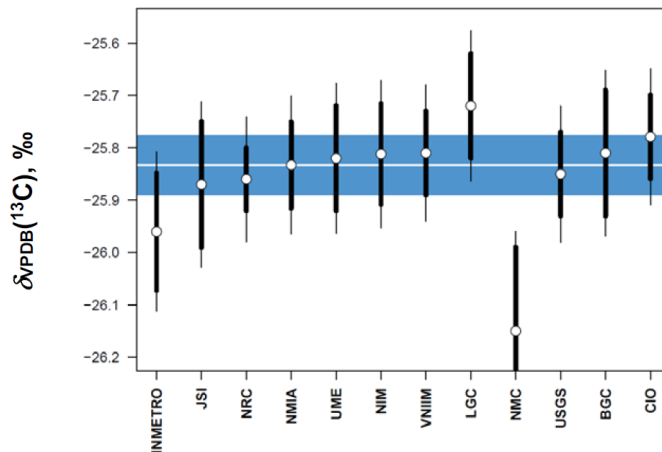
# CIPM-MRA related outputs from CCQM activities (2019-2022)

**50** New CCQM Comparisons initiated

**47** CCQM Comparison reports published

**CCQM-K167 and  
CCQM-P211**

**Carbon Isotope delta  
measurements of  
Vanillin**



**First comparison reports  
of newly formed  
CCQM Isotope Ratio WG  
published**



# Highlights of CCQM activities (2019-2022)

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## CCQM's Role:

- Global forum for progressing the state-of-the-art
- Facilitating dialogue between NMIs and stakeholders
- Global comparability of measurements

## Examples:

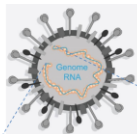
- 1) Ensuring reliability of measurements in response to Covid-19
- 2) Supporting GHG mitigation and Clean Air initiatives
- 3) Addressing new challenges: microplastics, particle and viral measurement



# CCQM comparisons supporting reliability of Covid-19 testing

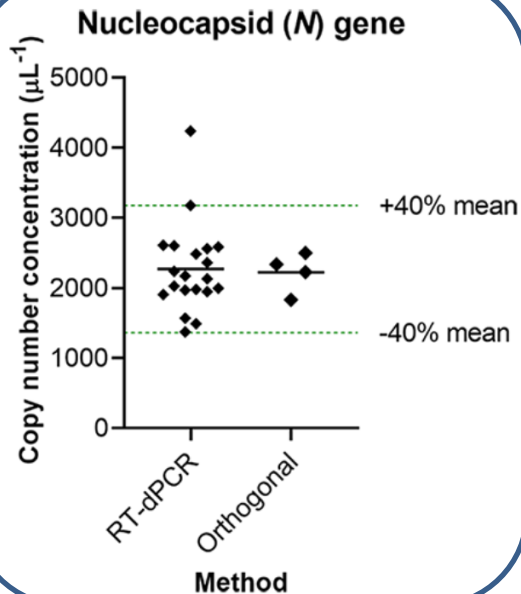
## CCQM P199b: SARS-CoV-2 RNA copy number quantification

Coordinators: NML@LGC, NIM, NIBSC, NIST



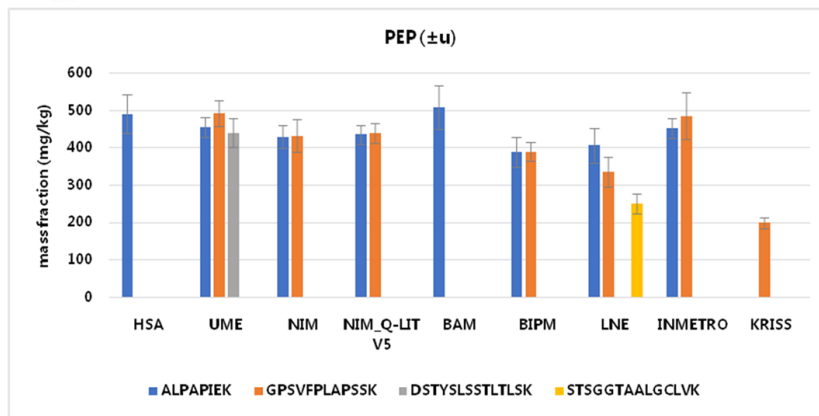
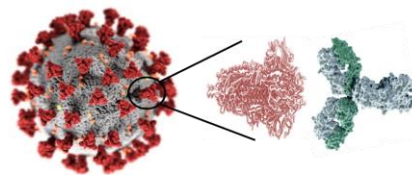
Measurand 2:  
Copy number concentration  
Envelope (E) gene  
full sequence

Measurand 1:  
Copy number concentration  
Nucleocapsid (N) gene  
partial sequence



## CCQM-P216: SARS-COV-2 Monoclonal Antibody quant.

Coordinators: NIM, NRC, BIPM



# CCQM Workshop on Metrology for Infectious Diseases and Pandemic Preparedness 5-7 October 2021



CCQM-WS

Select



View

## CCQM Workshop: A roadmap for metrology of infectious disease and future pandemic readiness

5 to 7 October 2021

### Day 1: Lessons learned from COVID-19 pandemic: the measurement technology and data challenges

Output: Agreed challenge areas essential to address a future infectious disease pandemic

### Day 2: Characterising the challenge areas

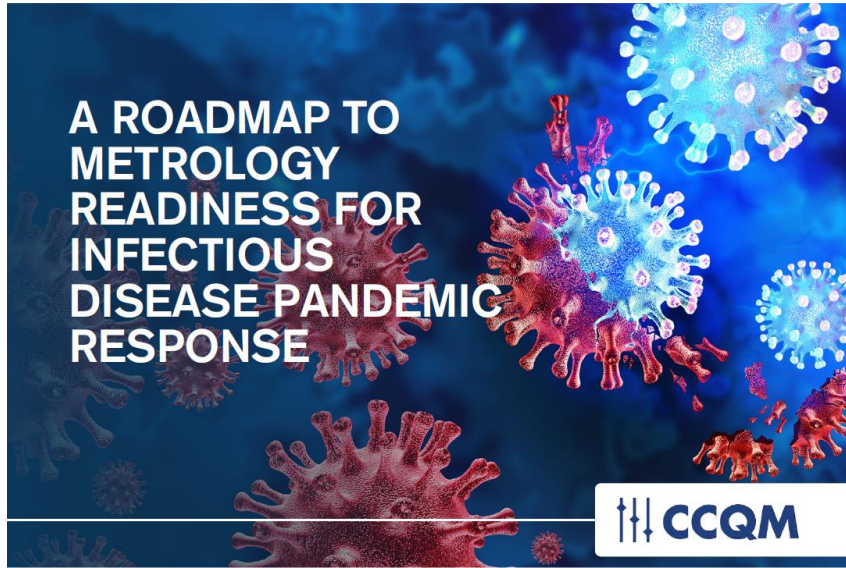
Output: Recommendations for what detection technologies and materials – metrology solutions required - within what networks - in support of what processes (for which the NMIs would have greatest added value).

### Day 3: Roadmap development

Output: Establish a Task Group to develop the draft roadmap document, for review and publication by CCQM.



# Metrology readiness for pandemic response



- Published September 2022
- A CCQM Task Group will implement recommendations over the next 15 months, including:
- 'Fire-drill' comparisons to enable rapidly deployable reference methods and materials worldwide
- E-learning modules development

# Towards improved accuracy of Surface Ozone monitoring worldwide

## Recommendation 1 (2020):

On the recommended value of the ozone absorption cross-section per molecule at 253.65 nm (air) for applications including the measurement of atmospheric ozone amount fractions



*Implementing a Globally Coordinated Change in Ozone Cross Section  
Value*

recommends that

*for Surface Ozone Monitoring*

- the 2019 value of  $1.1329 \times 10^{-17} \text{ cm}^2$  [2] and standard uncertainty  $0.0035 \times 10^{-17} \text{ cm}^2$  [2] be adopted for the ozone absorption cross-section per molecule at 253.65 nm (air) for use in ozone measurement standards maintained at the BIPM and for the calculation of the reference value for the BIPM.QM-K1 on-going comparison of surface ozone measurement standards,



# New Ozone Cross Section implementation planning



Working Groups

Select

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## CCQM Task Group for Ozone Cross Section (CCQM-GAWG-OZONE-TG)

### Chair

**Prof. Paul Brewer**  
Quality Life Division  
National Physical Laboratory  
United Kingdom

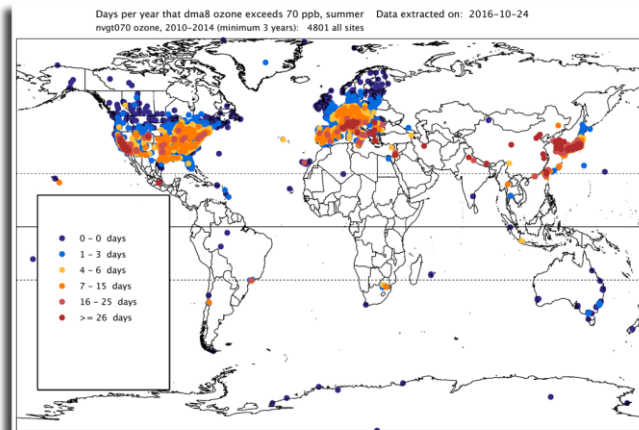
### Executive Secretary

**Dr Joële Viallon**  
Bureau international des poids et mesures  
France

ALL MEMBERS

### Terms of reference

- To establish and publish a timeline for implementing the change in the ozone cross section value used worldwide for surface ozone measurements to the CCQM.O3.2019 value<sup>1</sup>, taking into account the times needed for documentary change as well as implementation of the change in measurement instruments and networks, and actions necessary by various stakeholders. The 'intention-to-change statement' developed from the BIPM/CCQM-GAWG 2020 workshop, foresees a 3 to 5-year change process with the date of 1 January 2024, identified as a provisional start date.
- To identify regulations and documentary standards worldwide, in addition to ISO 13964, EN 14625 and US EPA 40 CFR Appendix D to Part 50, that would require change including their interrelationships. Identify the periods required for change of these documents and identify organizations/individuals able to initiate and keep track of the change process.
- To develop a website where all information on the change process can be disseminated from.
- To establish and maintain a database on interested stakeholders enabling updates on progress of the change process to be disseminated.
- To continue to promote best practice to the user community of flagging (providing metadata) on ozone mole fraction measurements, clearly identifying which cross-section value is used for

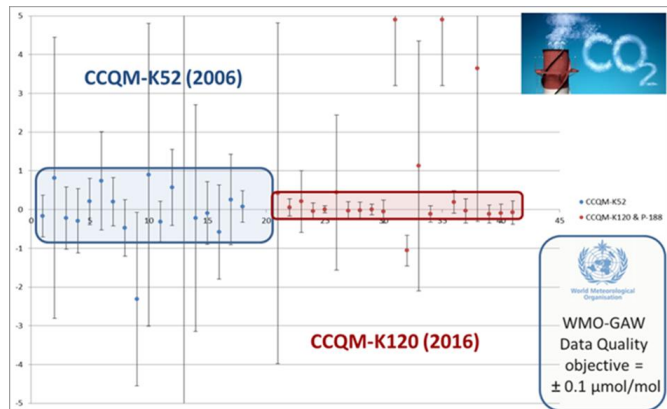


### Clean Air for All

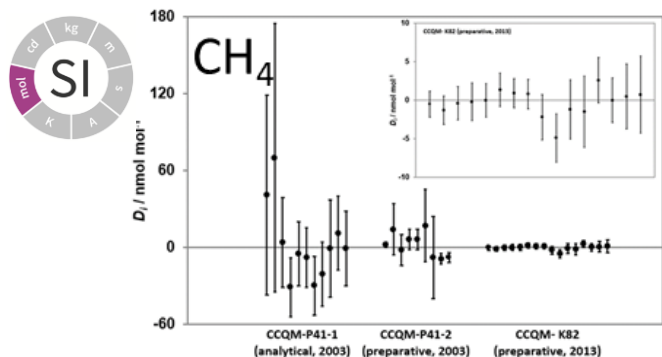
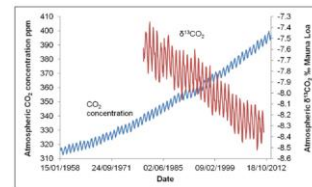
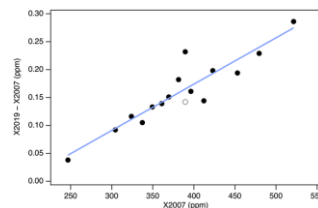


# CCQM Comparisons underpinning GHG Emission Mitigation

## CCQM comparisons for major GHG gases



Revision of the World Meteorological Organization Global Atmosphere Watch (WMO/GAW) CO<sub>2</sub> calibration scale (2019)

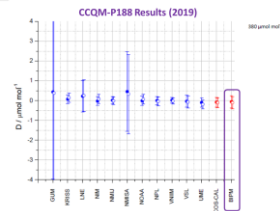


**CCQM**  
Working Groups

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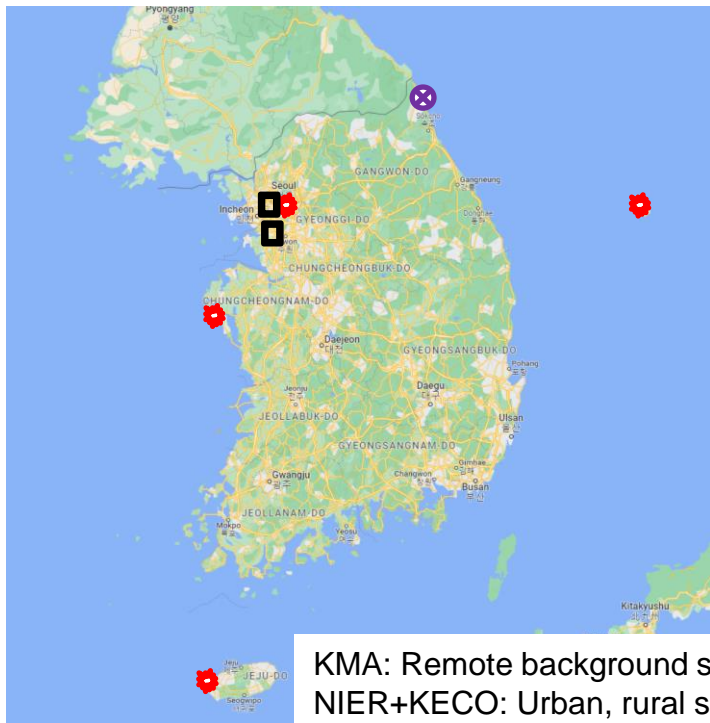
## CCQM-GAWG Task Group on GHG Scale Comparisons (CCQM-GAWG-TG-GHG)



On-going comparisons for CO<sub>2</sub> in air measurement  
CCQM-P225  
BIPM.QM-K2  
BIPM.QM-K5



# Example: GHG Emission Monitoring Networks (Korea)

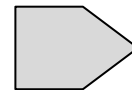


Over 100 new GHG monitoring sites to be established in Korea in next 5 years

KRISS to provide calibration standards

Current

- 🌸 KMA: 4 sites
- NIER: 2 sites
- ⊗ KECO: 1 site



Planned until 2027

- KMA: 4+α sites (?)
- NIER: 106 sites**
- KECO: 1+α site (?)



GHG  
monitoring  
instruments  
operated by  
KMA

**KRISS**  
Korea Research Institute of Standards and Science

Provision of Gas  
Calibration Standards

# CCQM Workshop on Metrology for Microplastics, 5-6 April 2022

## CCQM Workshop on Microplastics measurements and standards

5 to 6 April 2022


The CCQM online workshop on Microplastics Measurements and Standards took place on 5 and 6 April 2022. Registered participants can now access the presentations in the section Workshop documents below.

### Aims:

- To understand measurement and standards needs for microplastic contamination characterization and quantification
- To recommend specific metrology interventions to establish robust metrology system for microplastic measurement



# CCQM Workshop on Particle Metrology



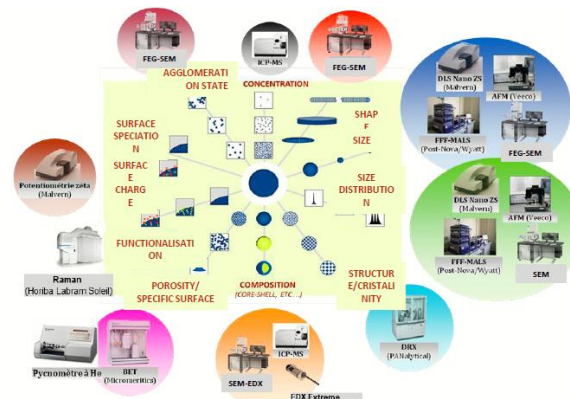
To identify activities that can be undertaken within CCQM, and to develop a CCQM action plan

The diagram shows a horizontal logarithmic scale with major ticks at 1.E-09, 1.E-08, 1.E-07, 1.E-06, 1.E-05, and 1.E-04. Below the scale, five biological entities are represented by images and labeled:

- Proteins:** Shown as a 3D ribbon model of a protein complex. Scale bar: 1 nm.
- Viruses:** Shown as a spherical virus particle. Scale bar: 50 nm.
- Bacteria:** Shown as a cluster of rod-shaped bacteria. Scale bar: 500 nm.
- Spores:** Shown as a spiky, spherical spore. Scale bar: 1 μm.
- Pollen:** Shown as a large, irregular pollen grain. Scale bar: 5 μm.

Below the scale, the following values are listed in red text:

- 1 nm
- 10 nm
- 100 nm
- 1 μm
- 10 μm
- 100 μm



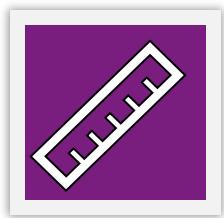
# CCQM Workshop on Metrology for Viral Systems, 2023

## CCQM workshop "Metrology for Viral systems as molecular tools"

24 to 27 January 2023



Information exchange with stakeholders on metrology support for biotechnologies utilizing viral vectors



To identify activities that can be undertaken within CCQM, and to develop a CCQM action plan



Full capsids



Partially-filled capsids



Empty capsids



Aggregates

Gimpel, Andreas L et al. "Analytical methods for process and product characterization of recombinant adeno-associated virus-based gene therapies." *Molecular therapy. Methods & clinical development* vol. 20 740-754. 17 Feb. 2021

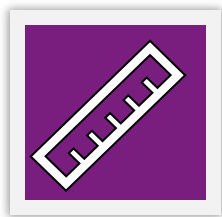
# CCU/CCQM Workshop for count-based Quantities

## CCU/CCQM Workshop for Quantities which can be counted

28 to 30 March 2023



To trigger discussion across the metrological community on counting and number quantities to achieve better common understanding



To generate clear guidance for unified nomenclature for these quantities and to understand more clearly routes to traceability

In addition to  
CCQM and CCU  
contributions  
from CCEM,  
CCM, CCRI, CCL,  
CCTF & CCPR



# Thank you very much to all members and supporters!



CCQM 2019 Spring