NRC·CNRC

Metrology Research Centre

“What’s a CIRMS for?”

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NRC Canada; ICRU; CCRI(I)

Acknowlegements

I acknowledge that where I live and work in Ottawa is situated on the unceded and unsurrendered territory of the Anishnabe Algonquin Nation, whose presence there reaches back to time immemorial.

A land acknowledgement doesn't change anything on its own, but it reminds us of our relationship to the places in which we have settled.

I also have to acknowledge that although I work for the NRC Canada, I'm talking about my engagement with the CCRI, and I'm here in my role with the ICRU.

National Research Council Canada | Conseil national de recherches Canada

INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS • ESTABLISHED IN 1925 • ICRU

CCRI

THESIS — WE'RE IN A TIME OF DISRUPTION

Disruption is always present

Disruption is always uncomfortable

Disruption is always an opportunity

"Today is always the day to think about change"

CIRMS today

CIRMS is a great 'product', pretty much unique in the ionizing radiation space

Where else can you meet academics, regulators and industry partners involved in ALL applications of ionizing radiation?

IAEA has a wider reach but tends to be more compartmentalized

CCRI (BIPM) is limited to National Metrology Institutes and a small number of stakeholder organizations

CIRMS tomorrow

It's already all in the title!

Council on Ionizing Radiation Measurements & Standards

"Bringing together stakeholders to develop measurement capabilities and standards for enhancing the use of ionizing radiation for societal benefit"

No mention of countries, regions

HYPOTHESIS

CIRMS can play a crucial role linking the NMI community worldwide to end users across all of ionizing radiation

BIPM
CCRI
Primary standards

CIRMS
Techical expertise & industry knowledge

Industry & Society
Accurate measurement at point of use

OUTLINE

BIPM
CCRI
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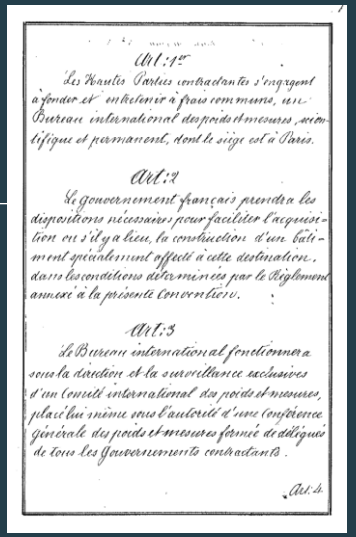
1. Introduction to CCRI
2. Strategic Plan
3. An opportunity for CIRMS

A Brief History of Metrology



Art. 1er

Les Hautes Parties contractantes s'engagent à fonder et entretenir à frais communs, un Bureau international des poids et mesures, scientifique et permanent, dont le siège est à Paris.

Art. 2

Le gouvernement français prendra les dispositions nécessaires pour faciliter l'acquisition ou s'il y a lieu, la construction d'un bâtiment spécialement affecté à cette destination, dans les conditions déterminées par le Règlement annexé à la présente Convention.

Art. 3

Le Bureau international fonctionnera sous la direction et la surveillance exclusives d'un Comité international des poids et mesures, placé lui-même sous l'autorité d'une Conférence générale des poids et mesures formée de délégués de tous les Gouvernements contractants.

Art. 4.

Metre Convention signed in Paris in 1875 (17 nations)

Established permanent organizational structure for members on all matters relating to units of measurement

Created the BIPM – Bureau International des Poids et Mesures

- **Intergovernmental organization**
- **Under authority of General Conference on Weights and Measures (CGPM)**
- **Under supervision of the International Committee for Weights and Measures (CIPM)**
- **Acts in matters of world metrology and facilitates needs to demonstrate equivalence between national measurement standards**

Remains the basis of international agreement on units of measurement

Organizational structure

The organisation
The Metre convention

General Assembly
CGPM

Board of directors
CIPM

Executive committee
The Bureau

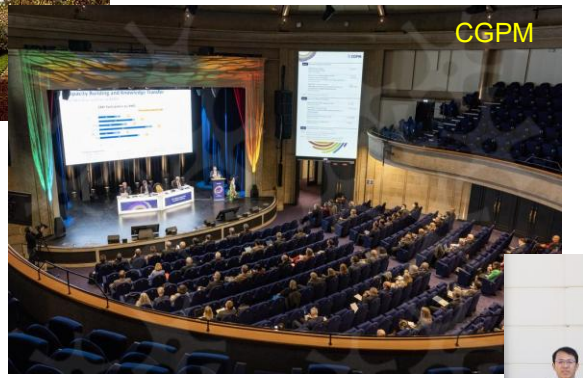
CEO
Director of the BIPM

Premises/ staff
BIPM

Working Groups

Subsidiaries
Consultative Committees
Joint Committees

CCRI



Dr Olthoff (NIST) is the CIPM VP

The role of the CCRI?

Consultative committees are the primary forum for discussing progress on primary standards and determining future directions (for NMIs and BIPM)

Activities:

Consultation!

Definitions of quantities and units

Standards for x-ray, γ-ray, charged particle and neutron dosimetry, radioactivity measurements

Advise the CIPM regarding IR standards and BIPM activities

Provide input to CCRI Strategy

3 distinct sections – **dosimetry**, **radioactivity**, **neutrons**

So, what's the application space CCRI addresses?

Healthcare

Security

Energy

Food safety

Climate change & Environment

Diagnostic Imaging

- Medical imaging approaches 50 % of the collective dose to the population in some countries
- 4 billion patients including 4 million nuclear medicine images

Radio-therapy

- 5 million patients per year (external radiotherapy, brachytherapy and radiopharmaceutical therapy)
- 50 % of cancer patients are treated using radiotherapy
- New modalities, radiopharmaceuticals

Industrial

- 12M m^3 medical devices sterilized per year
- Foodstuffs irradiation, materials modification……..

Protection /security

- 22million people (11 million workers) exposed
- Accelerator & laser facilities, Air & space travel.
- Nuclear Forensics

Nuclear power

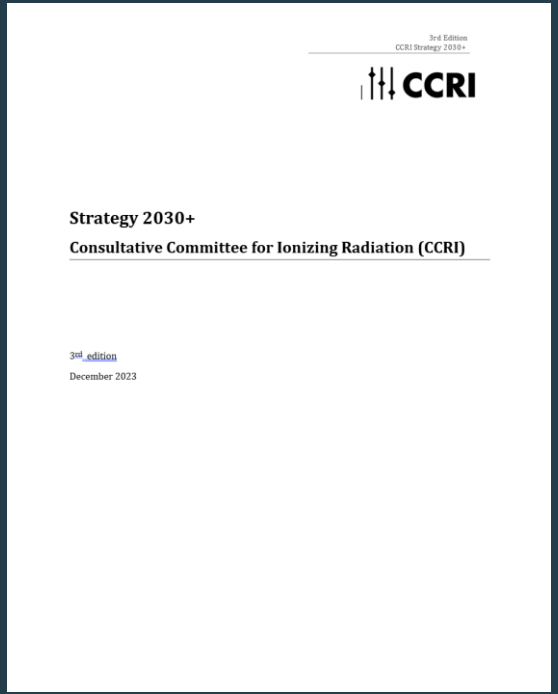
- 450 power plants, 31 states, 10% of world's electricity
- New small modular reactors & fusion
- Safe disposal of waste from legacy plants

Environ-ment and climate

- Natural radiations monitoring (terrestrial and cosmogenic)
- Radioactivity in air, soil & food
- Nuclear and isotopes technics used in monitoring greenhouse gas emissions (CO_2, N_2O, CH_4), in evaluating origin, status and movement of water in soil and air, in studying oceans.

CCRI

The CCRI Strategy – an international needs report



Scientific, economic, and social challenges

- Climate change and environment
- Health and Life Sciences
- Food safety
- Energy
- Advanced manufacturing
- Digital transformation
- New metrology

https://www.bipm.org/en/committees/cc/ccri

Societal / Scientific Driver #1: Growing global cancer burden leading to the expansion of radiotherapy technologies

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Advanced metrology for medical applications	• Develop standards for the dosimetry of radiotherapy beams at **small length** and **time scales** (e.g. for **FLASH**. **SFRT**) • Advance the dosimetry of **brachytherapy** techniques to match accuracies possible in external beam radiotherapy. • Strengthen traceability for **proton and hadron therapy** • Develop traceable phantoms for **quantitative medical imaging** • Improve radionuclide metrology for **theranostics** • Develop traceable neutron metrology for **BCNT**	Improved implementation of new therapeutic techniques Safer patient dosimetry Global comparability of medical radiation measurements to enable faster and more reliable clinical trials.

Societal / Scientific Driver #2: Expansion of nuclear medicine and medical imaging

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Quantitative imaging and radionuclide metrology	• Improve measurement standards for **emerging medical radionuclides** • Support accurate **patient-specific dosimetry** • Develop links between **activity** measurements and **imaging** systems	More effective personalized medicine Improved treatment efficacy and patient safety

Societal / Scientific Driver #3: Environmental monitoring, climate science and radiation protection

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Radiation metrology for environment and society	• Improve traceability for **ultra-low-level radionuclide measurements** • Develop techniques for **environmental dose reconstruction** • Support community in the transition to **ICRU operational quantities** • Expand measurement capabilities for **cosmic radiation** exposure • Support collaborative research activities in **low-dose radiobiology** to elucidate cell and tissue response.	Better environmental monitoring, improved radiation protection for workers and the public, improved understanding of radiobiological response.

Societal / Scientific Driver #4: Nuclear energy transition and decommissioning of legacy facilities

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Metrology for nuclear energy systems and lifecycle	• Develop measurement techniques for **radioactive waste** characterization , including **imaging methods**. • Improve radionuclide measurements in **complex materials** • Support metrology needs for **fusion neutron diagnostics and SMRs**	Safer and more cost-effective decommissioning Improved monitoring of nuclear installations

Societal / Scientific Driver #5: Growth of radiation-based industrial processes

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Metrology for radiation processing and industry	• Improve traceability for **radiation sterilization** and **food irradiation** • Develop dosimetry methods for **accelerator-based irradiation facilities** • Support **best-practice dosimetry** in LMIC industrial facilities. • Accelerate the implementation of **radiation simulation techniques** to simplify dosimetry and increase efficiency of processes.	Improved food safety, reliable sterilization of medical devices, and efficient industrial radiation processes

Societal / Scientific Driver #6: Emerging detector technologies and advanced materials

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Next-generation radiation measurement technologies	• Develop standards using **cryogenic microcalorimeters** • Explore **advanced detector materials** (perovskites, quantum dots, etc.) • Integrate **mass spectrometry** in radionuclide metrology	Improved sensitivity New primary measurement techniques Expanded measurement capabilities

Societal / Scientific Driver #7: Nuclear security and global safety challenges

Strategic Priority	Key Actions (Short–Medium Term)	Expected Impact
Metrology for nuclear security and forensic science	• Develop measurement standards for **nuclear forensic analysis** • Improve the **accuracy and efficiency of traceable, portable** neutron and gamma interrogation systems	Strengthened nuclear security and law-enforcement capabilities

CIRMS – a CCRI multiplier

- ✓ The NMI community in IR is international but relatively small
- ✓ The activities of the CCRI and CIRMS are very much aligned
- ✓ Both in terms of vision/mission and technical focus
- ✓ Strategic challenges can be driven quicker through collaboration, tapping into the metrological expertise and capacity of CIRMS members

So what's a CIRMS to do?

Expand the focus

Extend the relevance

Ensure the US/NIST relationship

Embrace CIRMS$_{\text{international}}$

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Thank you

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