Optimizing the Spanish National Metrology infrastructure

CONSEJO SUPERIOR DE METROLOGÍA

by enhancing the strengths and mitigating the weaknesses of a distributed national measurement system

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¹Including many slides supplied by of J.A. Robles (CEM) and contributions from Spanish DIs in the CLA

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Opening Pandora's Box



- The Spanish National Metrology System
- Strengths
- Weaknesses
- Co-ordination and supervision
- Future recommendations



The Spanish National Metrology System

- Strengths
- Weaknesses
- Coordination and supervisión
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HIGH COUNCIL FOR METROLOGY (CSM)

(Maximum consultative body on metrological policies. Inter-ministerial character)



NATIONAL METROLOGY SYSTEM. COORDINATION



Scientific Metrology and dissemination

State General Administration

Centro Español de Metrología and Associate Laboratories

Development and materialization of national standards and the first step of dissemination

→ First level calibration of infrastructure (collected in BIPM database)

Business Sector

Accredited laboratories

 \rightarrow Calibration

→ Testing



NATIONAL METROLOGY SYSTEM. SCIENTIFIC METROLOGY



Agents

CENTRO ESPAÑOL DE METROLOGÍA

- → Spanish National Metrology Institute
- → Created by Law 31, 1991
- \rightarrow Highest body of the General State Administration in the field of metrology
- → CIPM-MRA Signatory
- → Member of EURAMET

Associate Laboratories (DIs)

- → Responsible for certain units for reasons of expertise and technical competence
- Appointed by de Government by Royal Decree
- → Work in coordination with CEM
- → Participate as Designated Institutes in EURAMET
- → Recognized by the CIPM-MRA

National Standards

SI Base Units

- → kilogram (CEM)
- \rightarrow meter (CEM) → kelvin + EIT 90 (CEM)
- → ampere (CEM)
- \rightarrow second + UTC (ROA) \rightarrow candela (IO-CSIC)

Derived Unit of SI

- CEM: Various units related to the quantities: pressure, force, volume, density, angle, flatness, resistance, current and other electric quantities, etc.
- \rightarrow I.O-CSIC: Various units related to the quantities: luminous flux, luminance, spectroradiometric scales, spectrophotometry and quantities associated to fiber optics.
- → INTA: High frequency electrical quantities, humidity.
- → LMRI-CIEMAT: Ionizing radiation
- LCOE: High voltage electrical quantities
- → ISCIII: Ozone concentration

NATIONAL METROLOGY SYSTEM. SCIENTIFIC METROLOGY



The Spanish National Metrology System

Strengths

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- Efficient use of material and human resources
- Presence in areas beyond scope of NMI (e.g. ROA, IO-CSIC, CIEMAT, INTA, ISCIII or LCOE). Opens contacts with Research Institutes, Technological centres and Universities.
- Chance to share resources & know-how



STRONG POINTS



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- Management of QMS that don't always fit in well within that of the parent organization.
- Metrological activity is sometimes of low relevance for the misión of the institution hosting the DI.
- DIs often have to work with two different organizational systems.
- Dificulty to obtain human and material resources within the organizations.
- Dificulty to develop joint actions (e.g. training) and share resources due to organizational differences in the institutes.

WEAK POINTS



- <u>Short term</u>: Budgetary restrictions and limited Human Resources. No excuse for reducing activity in short term. Resolved with special temporary contracts charged to projects.
- <u>Medium term</u>: Situation becomes more complicated in public research centres as senior structural staff retire. Current policy on limited replacement puts in jeopardy maintaining talent and know-how as there is no effective overlap.
- Metrology requires continuity beyond temporary contracts to maintain the level of excellence for scientific metrology.
- Although objectives are being met, further aspects need improving such as participation in R&D projects, training and joint use of facilities

WEAK POINTS



- Institutes participating in the CIPM MRA and wishing to publish CMCs in the KCDB should note and consider the following points concerning traceability [5]:
- Traceability to the SI can be via the laboratories' own primary realisation or alternatively via services offered by another recognized NMI/DI or laboratory participating in the CIPM MRA, and publishing CMCs for these services in the KCDB. Details can be found on specific CIPM documents published by the BIPM.
- Traceability at the national level cannot come via an institute not being an NMI/DI (irrespective of whether it is accredited or not-accredited).

EXAMPLE PRIMARY REALIZATION OF DEW-POINT TEMPERATURE: Traceability in temperature and pressure



WEAK POINTS: MEETING CIPM-MRA-D-06



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- Clear legal base and regulations
- Institutions with a large trajectory in metrology in charge in quantities need for the country
- Limited number DI involved in more than one quantities and large ranges not covered by NMI
- To be intensive and not extensive
- Same goal and effective coordination inside the country







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Relevant requirements to be DI

- The laboratory demonstrates impartiality and lack of conflicts of interest or influence from third parties
- The range of the quantity of the proposed National Standard must be large enough to justify the designation as DI, not as a collaborating laboratory
- The laboratory operates under a quality management system based on EN ISO/IEC 17025 and, if applicable, on ISO Guide 34. The implementation of ISO 14001 is recommended



- Scientific and technical recognition at national and international levels. Publications and communications have been submitted to relevant international conferences, journals, and so on.
- the laboratory is actively participating in national and international projects at the highest level regarding national capabilities (R&D, metrological roadmapping & foresight and others)
- the laboratory is successfully participating in inter-laboratory comparisons (ILC)
- competence and stability of personnel must be demonstrated



- the laboratory has the resources (staff, financial, equipment, premises) to maintain national measurement standards and to participate in ILCs and international experts meetings (CC, TC, SC)
- the national measurement standards maintained by the laboratory are of relevance for the country and are in accordance with criteria established by the corresponding CC of the CIPM



- For bodies or laboratories belonging to an organization whose mission is not directly related with metrology:
- the body or laboratory ensures that the implementation, maintenance and continued development of National Standard are recognized as specific activities and strategic objectives.



Mechanisms for supervision and follow-up of DIs

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- report of laboratory results (ILCs at the highest metrological level, R&D projects, scientific publications, etc.) which is presented to other experts for evaluation (Every year, it is presented to the Scientific Commission of the National Council on Metrology, NCM.)
- quality management review of DIs performed by the NMI (Annual monitoring Visits or Audits, depending on the results of the previous Visits or TC-Q evaluation Report.)
- monitoring the annual reports and results of the TC-Q.

CO-ORDINATION AND SUPERVISION



- They have to be financed within their regular budgets
- In some cases, CEM helps buying equipment and making it available for the DIs





- Spanish DIs are very well known Institutions with a large trajectory in metrology.
- Until the 90s, they have been developing metrology tasks independently, and since then they have been able to join forces and to make agreements in order to articulate the today's national metrological structure.
- Our model is the result of a long tradition in metrology, which has led to our present structure, being robust and full of advantages.



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To cover the most of the country's metrological needs, using existing resources, : "Collaborating Laboratory".

This figure allows, through the establishment of a collaboration agreement, the joint use of certain facilities metrological measurement standards developed in very specific fields



CIH

CEM officially recognizes these Standards and assists in the development and maintenance.



- Sectorial laboratory process of revisión and development of strategic actions leading to a new focus of national metrology.
- Reinforce co-operation with leading industries and strategic sectors (energy, health, environment) to enhance their competitiveness and help them to be more innovative, and where justified, include them in the NMS as collaborating laboratories and potential DIs.







- The activities of the Spanish Dis in 2016 should continue to develop further in:
- R&D projects
- Continuous improvement of QMS
- Increase in technical competence and capability
- Continuity and increase in the services offered
- Training of specialists
- Increasing metrology awareness and impact on society

FUTURE RECOMMENDATIONS



Metrology infrastructure has to be:

- based in a clear regulation
- adapted to the needs of the Country
- simple and effective using institution with experience in the metrological fields

Coordinated

Same goal and effective coordination

