SImposio 2018 metrología

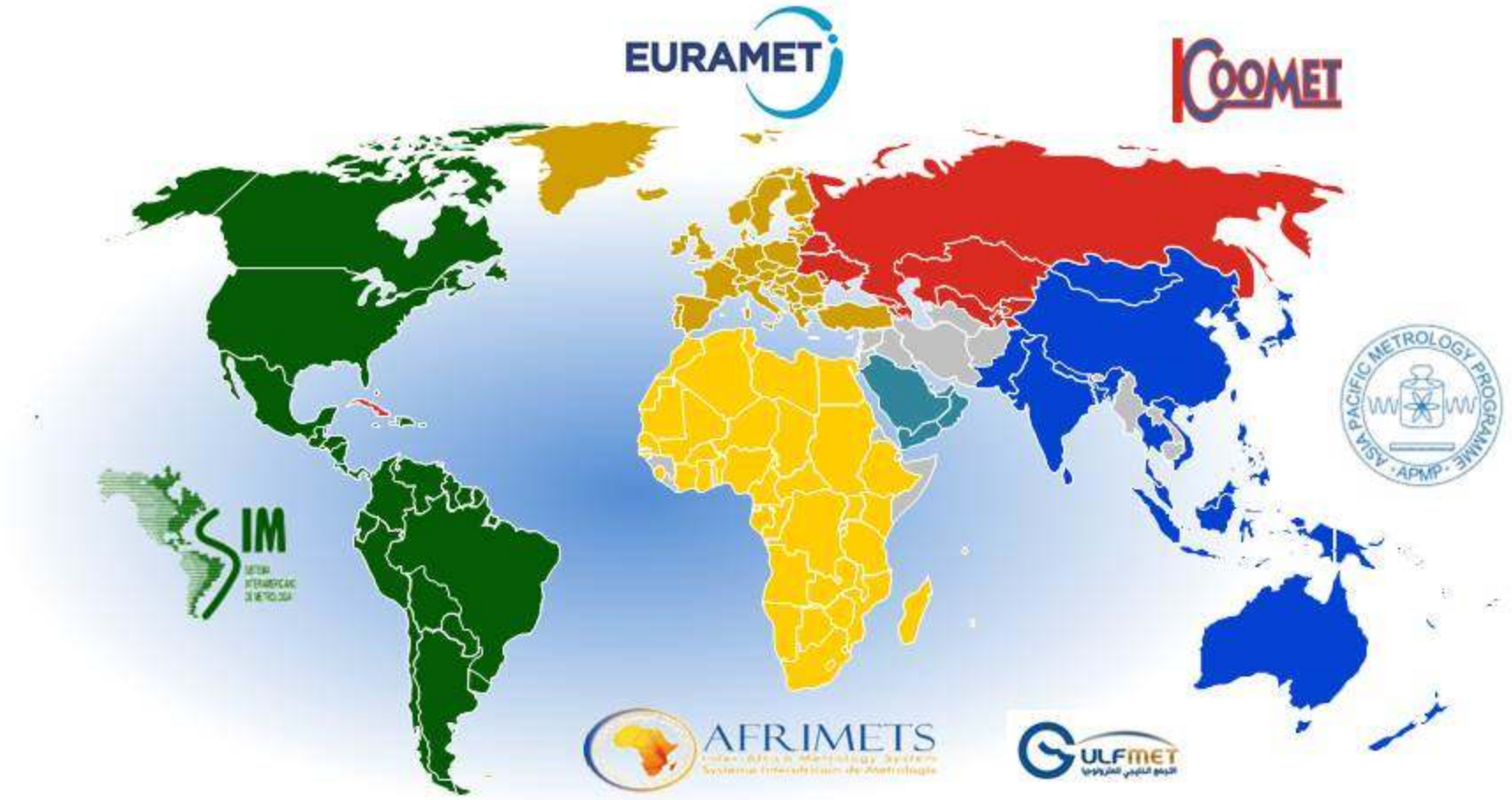
8 -12 octubre

Para la innovación tecnológica y el desarrollo sustentable

SIM CONTRIBUTION TO SUPPORT METROLOGY FOR INNOVATION AND SUSTAINABLE DEVELOPMENT IN THE AMERICAS

Héctor Laiz
SIM President
Gerente de Metrología, Calidad y Ambiente - INTI

Organizaciones Metrológicas Regionales



Vision

A representative, transparent, competent, and worldwide-recognized regional metrology organization.

Mission

To promote and support an integrated measurement infrastructure in the Americas which enables each member national measurement institutes to stimulate innovation, competitiveness, trade, consumer safety and sustainable development by effectively participating in the international metrology community.

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Strategic Objectives

I. Development of NMIs in the SIM Region

II. Building a Strong SIM Organization

III. Fulfill Regional Metrology Organization Obligations under the CIPM MRA

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II. Building a Strong SIM Organization

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Strategic Objective: Development of NMIs in the SIM Region

I.1 Develop Metrology for Innovation

ACTION I.1.1: The SIM Council in cooperation with the SIM Technical Committee will develop and implement a 3-year plan to support the development of the metrology needed for emerging technologies (i.e., advanced manufacturing, nanotechnology and biotechnology). This plan will also promote the growth of cooperation for research in metrology among SIM NMIs.

Resources: IADB Project

Strategic Objective: Development of NMIs in the SIM Region

I.2 Develop Metrology for a Sustainable Development

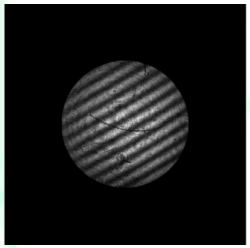
ACTION I.2.1: The SIM Council in cooperation with the SIM Technical Committee will develop and implement a 3-year plan to support the development of the metrology needed for Renewable Energies and Energy Efficiency.

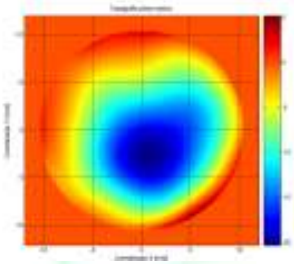
Resources: PTB Project. OAS-NIST Project

ACTION I.2.3: The SIM Council in cooperation with the SIM Technical Committee will develop and implement a 3-year plan to support the development of the metrology needed for Climate Science, Biodiversity and the Green Economy.

Resources: PTB Project. OAS-NIST Project

Project -> Strengthening National Metrology Institutes in the hemisphere, in support of emerging technologies





Tabulation of Proteins of Normal Serum[14]*

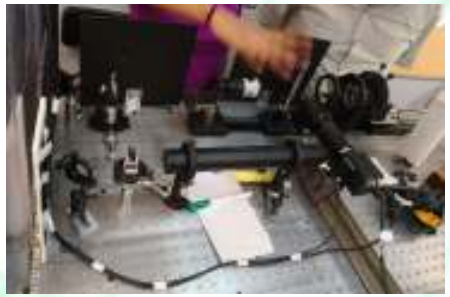
Protein	Classification No.	Concentration mg/100 ml	% of Peptide	Concentration of Peptide mg/100 ml	%N of Peptide Calc.	% Tyrosine of Peptide	Biuret Color of Peptide Relative to BSA†
Serum albumin	1						
Prealbumin	2						
α_1-lipoprotein	10						
α_1-acid glycoprotein	11						
α_1-antitrypsin	12						
α_1-easily precipitable glycoprotein	13						
Gc-globulin	21						
α_{1X}-glycoprotein	22						
Inter-α-trypsin inhibitor	23						
Haptoglobin	30						
Ceruloplasmin	31						
α_2-macroglobulin	33						
α_2-lipoprotein	34						
α_2-HS-glycoprotein	35						
β_1-lipoprotein	60						
Transferrin	61						
β_{1A}-globulin	62						
Hemopexin	64						
β_2-glycoprotein I	82						
IgG	90						
IgM	91						
IgA	92						
	Total						

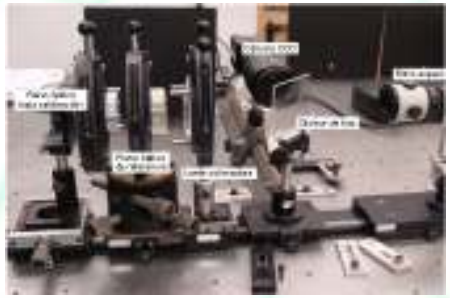
*Calculated from data of Schultze an
New York, Elsevier, 1966.
†Bovine serum albumin.
( )The values in the brackets were indirectly calculated from the stated amounts of nonpeptide constituents.

IMPROVEMENT AND UPDATING OF INTERFEROMETRIC SYSTEMS FOR TRACEABLE DIMENSIONAL NANOMETROLOGY AT SIM

This project focuses on cross validation of flatness calibration /measurement systems at two of SIM-NMIs (INMETRO and INTI), who already have a Fizeau interferometer for flatness-deviation calibration of optical flats, extending its traceability/metrological control to others SIM-NMIs, to develop capabilities in nanometrology.

INMETRO and INTI will automate optical flatness measurements with the help of CENAM (México), LACOMET (Costa Rica), and LATU (Uruguay) who will also receive the transfer of the technology and knowledge.



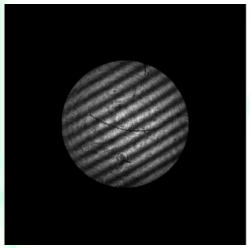
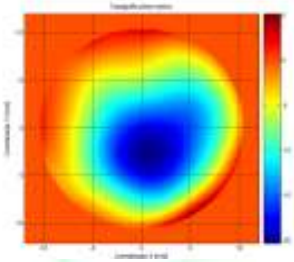
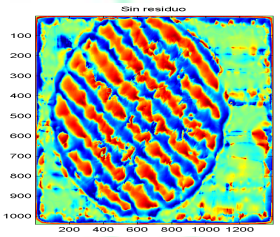


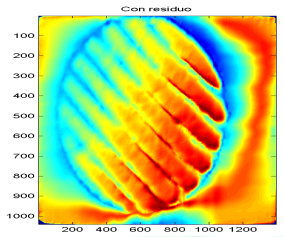
A SCHOOL OF ALIGNMENT AND TUNING WAS CARRIED OUT WITH THE INTERFEROMETER OF INTI.

INTI · LACOMET Laboratorio Costarricense de Metrología · LATU · CENAM Centro Nacional de Metrología · INMETRO

IMPROVEMENT AND UPDATING OF INTERFEROMETRIC SYSTEMS FOR TRACEABLE DIMENSIONAL NANOMETROLOGY AT SIM

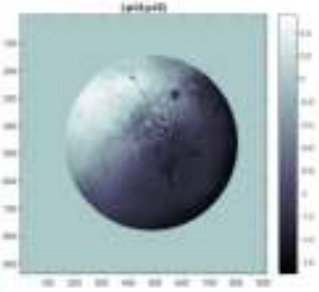
- **ANALYSIS OF UNCERTAINTY CONTRIBUTIONS FOR THOSE AUTOMATED SYSTEMS**



In order to evaluate the topography of the optical planes, the FFT METHOD ANALISYS method was evaluated and also the BIDIMENSIONAL EMPIRICAL MODE DECOMPOSITION (BEMD) & HILBERT SPECTRAL ANALYSIS (HSA). Both methods were finally rejected, and outweighed by the Takeda modified regularization method by CENAM.

- **TO PROVIDE TRACEABILITY TO THE OTHER SIM-NMIS IN THE NANOSCALE**




WE ARE DEVELOPING PHASE STEPPING ALGORITHM FOR THE ABSOLUTE MEASUREMENT OF FLATNESS.

IMPROVEMENT AND UPDATING OF INTERFEROMETRIC SYSTEMS FOR TRACEABLE DIMENSIONAL NANOMETROLOGY AT SIM

- **TO LAUNCH A STABLE BASIS FOR NEW COMPARISONS AT SIM IN FLATNESS DEVIATION**

It would be expected that the designs and improvements reached by this project will be transferred to all the SIMN MIs, for instance, CENAM, LACOMET and LATU, in order to replicate this type of system at their facilities.

LACOMET, STARTED THE DESIGN OF A HOME MADE FIZEAU INTERFEROMETER BASED ON INTI FACILITIES.

Carlos (CENAM), Liliana (INTI), Ricardo (INMETRO), Armando (CENAM), Leonardo (LACOMET)

LARGE-SCALE DIMENSIONAL METROLOGY

Evaluate the performance of large-scale measurement instruments such as laser trackers, total stations or photogrammetric systems to assure the measurements of large objects

OBJECTIVES:

- Verification and evaluation of the instrument in accordance with existing written standards.
- Development of calibration standards (artifacts).
- Development of calibration and verification methods.
- Evaluation of measurement uncertainty.
- Characterizations of influencing variables such as the refractive index of air.
- Evaluation and comparison of the different instruments and technologies (total stations, laser trackers, photogrammetry, etc.)

LARGE-SCALE DIMENSIONAL METROLOGY

• NPL (UK) provided the project with a script developed in Matlab that allows the evaluation of geometric errors of laser trackers with beam of light mounted on the head.

• CENAM performed the measurement of nests of points and sent the results of these measurements to the other laboratories to make these measurements.

In the next meeting we will analyze those results. Those points will be loaded into the software provided by NPL to find the geometry errors of the laser trackers.

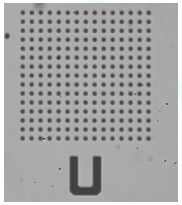
Janet (Perú), Octavio (México), Luiz (Brasil), Diego (Argentina) y Leonardo (Costa Rica)

CALIBRATION OF STANDARD REFERENCE MATERIAL FOR USE IN CALIBRATING THE MAGNIFICATION OR SCALE OF OPTICAL MICROSCOPY AND SCANNING ELECTRON MICROSCOPY

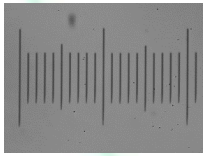
The implementation of algorithms for image processing for metrology purposes. This will enable our instruments to operate in a semi-automatic way to determine different geometric parameters such as the center of a circle, the intersection of a line with a plane, the parameters defining a cone, etc.

Aim: better tools to measure in the nano and micro range. The main challenge is to define algorithms for automatic image segmentation and image analysis procedures. Besides, it is also important to research its influences and uncertainty on the measurements results.

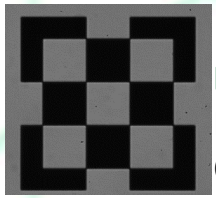
Reference Images



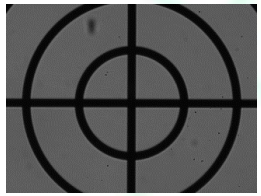
POSITION BETWEEN CIRCLES
Template for vision compensation Q



LINE STROKE POSITION
Rule from 0 to 1 mm



LINE WIDTHS
Reticle of pixel size
Q vision



DIAMETER OF CIRCLES
MAXLEVI Multifunction template 4x to 20x

INTI
LACOMET Laboratorio Costarricense de Metrología
INACAL INSTITUTO NACIONAL DE CALIDAD
CENAM CENTRO NACIONAL DE METROLOGÍA
INMETRO

CALIBRATION OF STANDARD REFERENCE MATERIAL FOR USE IN CALIBRATING THE MAGNIFICATION OR SCALE OF OPTICAL MICROSCOPY AND SCANNING ELECTRON MICROSCOPY

Experimentation/Circules position (Protocol)

- Determine the position of four circles with respect to a reference circle (central circle) in the three images.
- Determine radius of the 5 circles in the three images.
- Calculate average and total standard deviation.

(*) APPROVED MEASUREMENT PROTOCOLS, MEASUREMENTS IN PROCESS.


Grupo N


Grupo R


Grupo U

IMAGEN	CÍRCULO	COORDENADA (PIXELES)		RADIO		COORDENADA µM		DISTANCIA EUCLIDIANA
		X	Y	pixeles	µm	X	Y	µm
N_0001	1	1233.3	1038.7	145.4	13.40	113.70	95.76	
	2	1235.3	311.0	145.9	13.45	113.88	28.67	67.09
	3	1231.8	1766.4	145.7	13.44	113.56	162.85	67.09
	4	506.2	1037.4	145.4	13.41	46.66	95.63	67.04
	5	1960.9	1040.0	145.9	13.45	180.78	95.87	67.08
N_0002	1	1233.3	1039.7	147.7	13.62	113.70	95.84	
	2	1237.7	310.7	144.8	13.35	114.10	28.65	67.20
	3	1231.7	1767.5	147.9	13.64	113.55	162.94	67.10
	4	506.1	1038.3	147.8	13.62	46.65	95.72	67.05
	5	1966.7	1035.9	147.7	13.61	181.31	95.49	67.61
N_0003	1	1233.2	1038.6	147.5	13.60	113.69	95.74	
	2	1234.8	311.0	148.0	13.64	113.83	28.67	67.07
	3	1231.7	1766.1	147.8	13.62	113.55	162.82	67.07
	4	506.0	1037.3	147.7	13.62	46.64	95.63	67.04
	5	1960.7	1039.8	147.8	13.63	180.76	95.86	67.07

CALIBRATION OF STANDARD REFERENCE MATERIAL FOR USE IN CALIBRATING THE MAGNIFICATION OR SCALE OF OPTICAL MICROSCOPY AND SCANNING ELECTRON MICROSCOPY

Experimentation/Circules position (Protocol)

- Circle A positions within the field of view of the camera

Método y parámetros

Nº de puntos con los que se determine el círculo

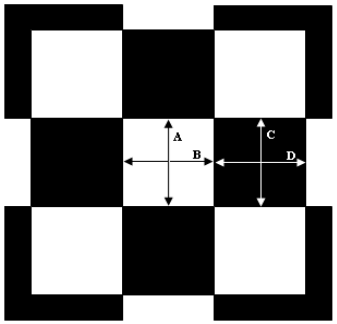
Método	zerocross	sigma	5			
		Tamaño	5 x 5			
Imagen	Superior	Radio	Centro en pixeles		No. puntos	Diámetro
		µm	x	y		µm
CEN_R0026	1	52.76	1935.36	1054.38	2740	105.52
CEN_R0042	2	52.77	1947.48	1072.54	2755	105.54
CEN_R0043	3	52.78	1926.15	1093.28	2734	105.56
	Promedio	52.77	1936.33	1073.40		105.54
	D. estándar	0.009				0.018

(*) APPROVED MEASUREMENT PROTOCOLS, MEASUREMENTS IN PROCESS.

CALIBRATION OF STANDARD REFERENCE MATERIAL FOR USE IN CALIBRATING THE MAGNIFICATION OR SCALE OF OPTICAL MICROSCOPY AND SCANNING ELECTRON MICROSCOPY

Experimentation/Circules position (Protocol)

- Positions of light and dark squares within the field of view of the camera



VALOR NOMINAL	VALOR MEDIDO EN µM			
µm	A	B	C	D
100	100.0	100.0	100.0	100.0
40	40.0	40.0	39.9	40.0
10	10.0	10.1	10.0	10.0

VALOR NOMINAL	DESVIACIÓN ESTÁNDAR µM			
µm	A	B	C	D
100	100.0	100.0	100.0	100.0
40	40.0	40.0	39.9	40.0
10	10.0	10.1	10.0	10.0

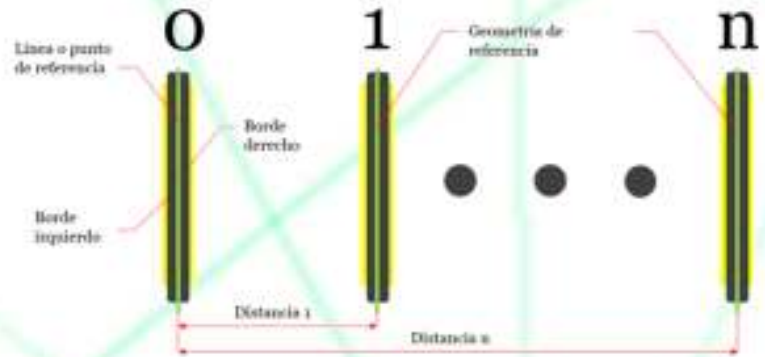
(*) APPROVED MEASUREMENT PROTOCOLS, MEASUREMENTS IN PROCESS.

CALIBRATION OF STANDARD REFERENCE MATERIAL FOR USE IN CALIBRATING THE MAGNIFICATION OR SCALE OF OPTICAL MICROSCOPY AND SCANNING ELECTRON MICROSCOPY

Experimentation/Circules position (Protocol)

- Positions of line strokes within the field of view of the camera

- Parameters to report



(*) APPROVED MEASUREMENT PROTOCOLS, MEASUREMENTS IN PROCESS.

Development of a Protein Certificate Reference Material (CRM), Bovine Serum Albumin

Aims

Set up measurement traceability for total protein quantifications.

Objectives

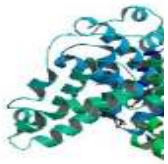
Develop the BSA Certified Reference Material.

- ***Introduce the LAC region to protein CRM production and certification according to ISO standards 30-35.***

Why BSA is important?

Tabulation of Proteins of

Protein	Classification No.	Concentration mg/100 ml	% of Peptide
Serum albumin	1	4000	99.0
Prealbumin	2	32	97.7
α_1-lipoprotein	10	320	92.8
α_1-acid glycoprotein	11	87	54.9
α_1-antitrypsin	12	355	73.3
α_1-easily precipitable glycoprotein	13	10	80.7
Gc-globulin	21	58	90.2
α_{1X}-glycoprotein	22	25	(77.3)
Inter-α-trypsin inhibitor	23	20	(90.9)
Haptoglobin	30	110	82.0
Ceruloplasmin	31	45	84.9
α_2-macroglobulin	33	300	84.8
α_2-lipoprotein	34	190	(7.3)
α_2-HS-glycoprotein	35	50	79.9
β_1-lipoprotein	60	360	(19.2)
Transferrin	61	260	95.2
β_{1A}-globulin	62	35	96
Hemopexin	64	90	70.5
β_2-glycoprotein I	82	23	76.3
IgG	90	1200	97.7
IgM	91	75	86.0
IgA			88.4



Images: Word Protein Data Bank, http://www.rcsb.org/pdb/explore/explore.do?structureId=5IFO

Production:
Scale up: By INTI

Analytic:
•Homogeneity study: INTI
•Stability study: CENAM
•Assignment of Value: INMETRO and CENAM

Impact of the Project

•The proposal is particularly interesting because **it develops capabilities in LAC NMIs** in this very sensitive area **Bio-metrology.**

• **the BSA CRM production**, enables each country to develop other standards to satisfy the needs of different sectors.

• This Project also seeks to create an regional working group in order to develop different protein CRMs, and ***Strengthening National Metrology Institutes in Bio-metrology.***

•This CRM will help **clinic, scientific labs and industry to improve their measurements.**

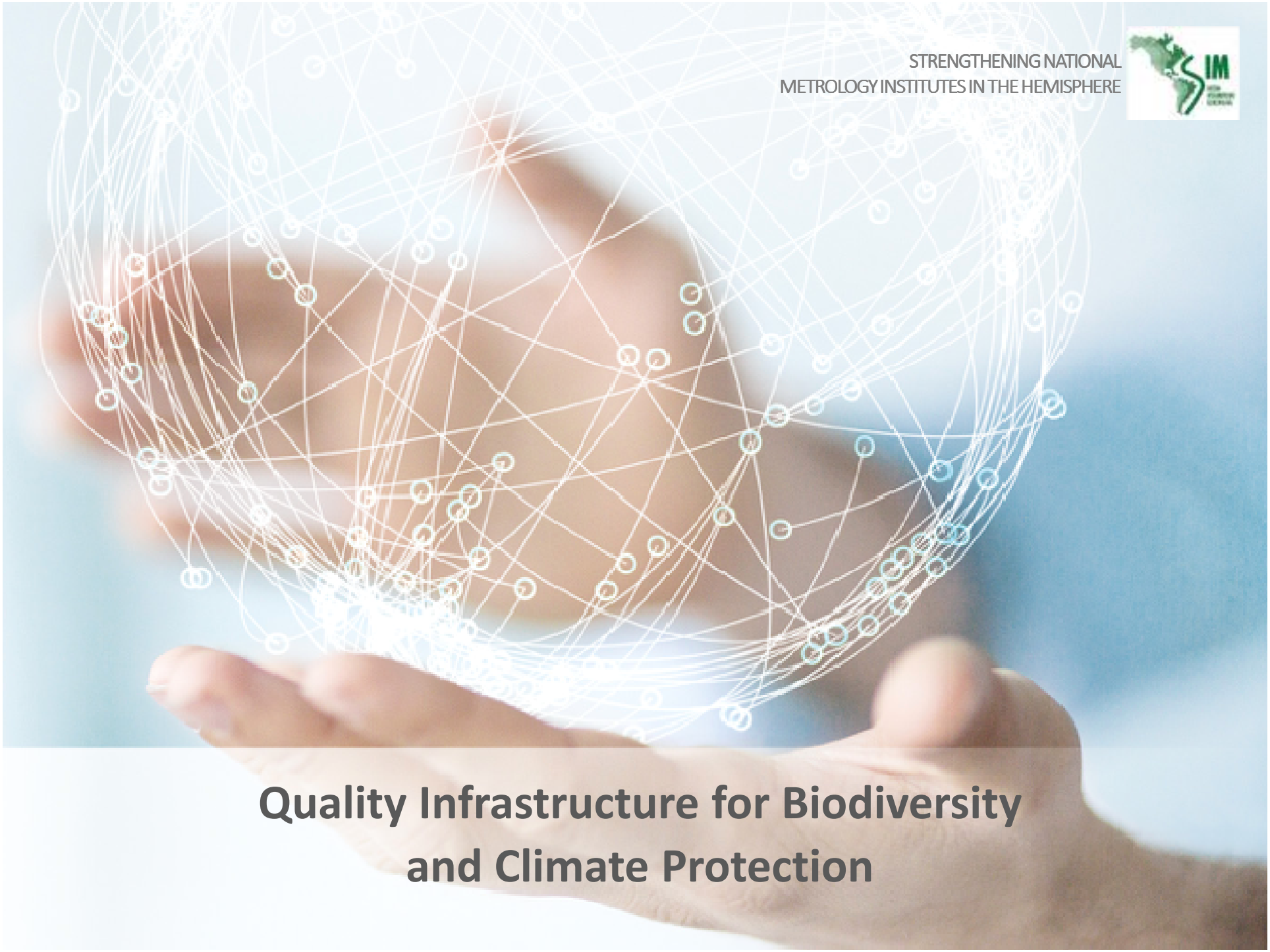
Networking

- Workshop, “Protein CRM and Bio-metrology”, 27- 29 de June de 2017, Río de Janeiro, Brazil.

- project RG-T2682 IDB, BSA reference material.

- Application for second step production further purification and lyophilized BSA CRM development.

- Development of a new proposal for “foot and mouth disease” DNA reference Material. Fast quantification and detection



STRENGTHENING NATIONAL
METROLOGY INSTITUTES IN THE HEMISPHERE

Quality Infrastructure for Biodiversity and Climate Protection

UV RADIATION

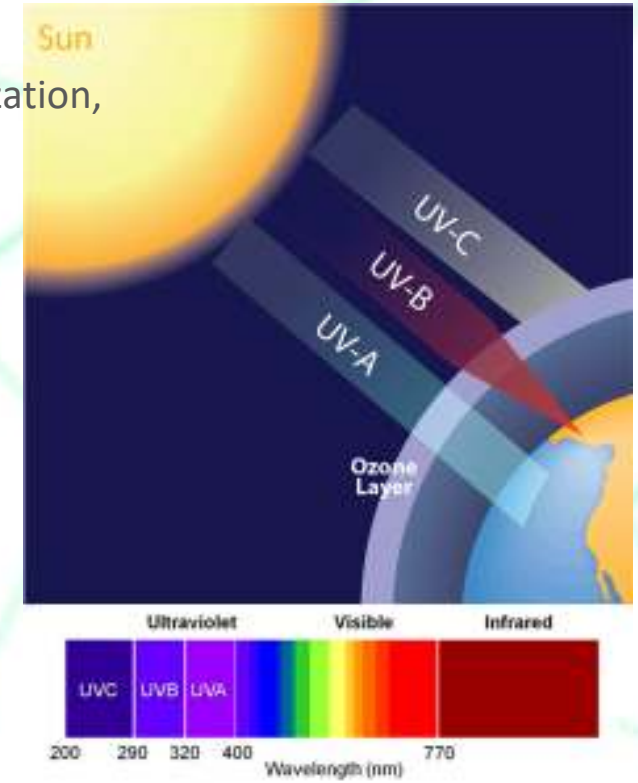
AIM: Realization of the spectral irradiace scale in the UV range

STATE :

- Subproject members are working with the equipment characterization,
- Virtual meetings carried out to adjust activities in the action plan

NEXT STEPS:

- Intercomparison workshop CENAM, INTI, INMETRO
- Training at INTI to IBMETRO & INACAL, date tbc



QUALITY ASSURANCE OF GRAINS (QUINOA)

STATE :

- Samples of the Reference Material were received by each country
- Protocols validation finalized June-July 2018
- Intercomparison carried out

NEXT STEPS:

- Analysis of the Intercomparison results
- Characterization measurements
- Meeting in Ecuador (October 2018)
- Definition of way forward with saponine test method.

VEHICLE EMISSIONS

AIM: provide traceability to gas measurements (Propane, CO and CO2) from emission of vehicle exhaust

STATE:

- Cylinder purchase was concluded satisfactory and received by INMETRO
- Advanced Training on Gravimetric Development and Analysis of Certified Reference Materials in INMETRO for persons from INEN, LATU and INM
- Preparation of the Reference Materials by INMETRO and participants done

NEXT STEPS:

- Shipment of the cylinders

Participants

INACAL Instituto Nacional de Calidad

INEN Servicio Ecuatoriano de Normalización

IBMETRO

INM Instituto Nacional de Metrología de Colombia

INTI Instituto Nacional de Tecnología Industrial

LATU

Mentoring

INMETRO

CENAM Centro Nacional de Metrología

GHG METROLOGY

- Subcoordinator & submitting organization: Jorge Koelliker, CENAM México
- Implementing partners: INTI Argentina, INMETRO Brazil, LATU Uruguay, IBMETRO Bolivia, INACAL Peru, UCR Costa Rica.

WORKPACKAGE 1

- Development of capabilities in CENAM & INMETRO to Support Atmospheric Measurement Research Community in CO2 measurements
- CRMs available in CENAM and INMETRO
- Internship form a person from LACOMET in CENAM to improve methods

WORKPAKAGE 2

- Identification of scope successfully finished.
- Gas mixtures purchased and arrived at part of the NMIs

NEXT STEPS:

- Training workshop in CENAM for method validation and capabilities development (Oct)
- SIM comparison planning

BIODIVERSITY MONITORING

GOAL: To ensure metrological traceability in chlorophyll, phosphorus and dissolved oxygen for the development of CRM and the calibrations of sensors

STATE :

- Training in measurement of dissolved oxygen - DO and phosphorus - P (Jun 17)
- Training in measurement of chlorophyll A – ChlA (Jul 18)
- Methods for analysis of DO and P Implemented in majority of NMIs

NEXT STEPS:

- Implementation of method for ChlA (Jun 19)
- Acquire reference materials and develop inter-comparisons to validate methods (in process, to be concluded Oct 18)
- Perform intercomparisons of the methods among the NMIs (Jun 19)
- Produce reference material in NMIs (Oct 19)

BIOGAS

AIM: traceability for calorific value of biogas

STATE OF THE ART:

- Biogas PRM purchase in progress, arrived at INMETRO, the others are pending.
- Biogas training at VSL - Holanda (April / 2018) for CENAM and INMETRO

NEXT STEPS:

- Receive the Biogas CRM at CENAM, INTI and INMETRO
- Biogas trainning at INMETRO for INTI participant
- Biogas trainning at IBMETRO by CENAM

BIODEGRADABILITY

GOAL: to measure the degree of biodegradability of organic chemical substances for industrial and domestic use (detergents and lubricants)

STATE OF THE ART:

- First regional meeting and specific training was held in Costa Rica (06/2018)
- The design of the interlaboratory comparison test was discussed and modified.
- The uncertainty analysis for biodegradability test was included in the action plan, and the possibility of drafting a scientific publication is being considered.

NEXT STEPS:

- Second Biodegradability training March 2019.
- An on-line course for uncertainty analysis, regarding basic and applied concepts will take place between September 2018 and March 2019.

METROLOGY FOR METEOROLOGY

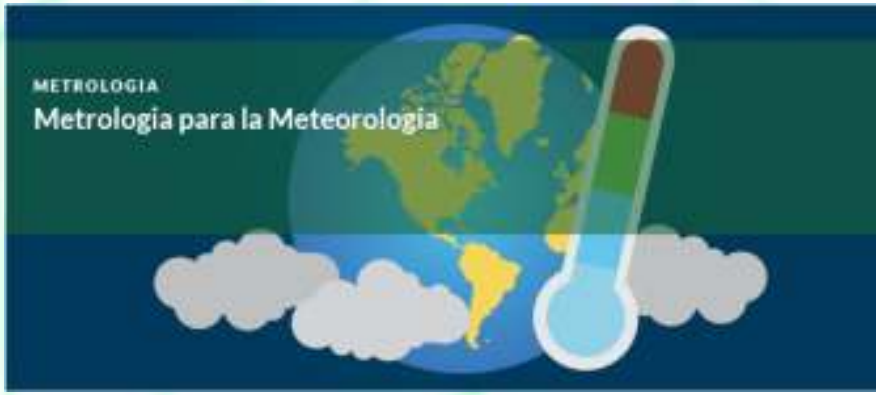
- Subcoordinator & submitting organization: Javier Garcia Skabar, INTI Argentina
- Implementing partners: Metrology and Meteorology Institutes from Argentina, Brazil, Costa Rica, El Salvador, Mexico, Panama, Peru, Uruguay

STATE OF THE ART:

- Training in metrology fundamentals for meteorologists. Panamá. Jun 2018.

NEXT STEPS:

- Internships of meteorologists in the metrology institutes (national level)
- Training in air velocity measurement. Nov. 2018
- Preparation of a technical protocol for AWS Calibration
- Preparation of a International intercomparison of AWSs



MERCURY

Goal:

To develop measurement capabilities to measure mercury in fish

STATE OF THE ART:

- Survey to know the capacities of the participating institutions and define the interest in the methods for harmonization.
- Collection, preparation and measurement of samples for preliminary evaluation of mercury contents.

NEXT STEPS:

- Workshop: “Definition and harmonization of measurement methods” Bogotá. Sep. 2018.
- Workshop: “Training in classical techniques for measuring elements in fish.” Querétaro. Nov. 2018.

Participants

INM Instituto Nacional de Metrología de Colombia

INTI Instituto Nacional de Tecnología Industrial

INMETRO

INEN Servicio Ecuatoriano de Normalización

CENAM Centro Nacional de Metrología

INACAL Instituto Nacional de Calidad

Mentoring

Canadá NRC·CNRC

Promoting Innovation in the Green Economy by including Quality Infrastructure In Latin America and the Caribbean

PILOT 2: STRENGTHENING QUALITY IN THE E-WASTE VALUE CHAIN

OBJECTIVE:
Strengthen the institutions of the QI, as a support to a better management of electrical and electronic equipment waste (RAEE), in the participating countries.

PARTICIPANTS:
SNC-OHA, Honduras; SNC-INEN, Ecuador; INTI, Argentina; INMETRO, Brasil; EMA, Mexico.

TIMEFRAME:
July 2017 – July 2019

IMPLEMENTED ACTIVITIES:
- Analysis of the general situation of the e-waste chain in the 5 countries, for prioritized products - analysis matrix, virtual meetings, Feb 18.
- Training in ISO Guide IWA 19, Tegucigalpa, Honduras, Mar 18.
- Presentation of CALIDENA methodology, Tegucigalpa, Honduras, Mar 18.

PLANNED ACTIVITIES:
- E-Waste workshop, training auditors ISO Guide IWA 19, Honduras, Nov 18
- E-Waste CALIDENA exercise, Quito, Ecuador, nov-dec 18
- Calidena Action Plan follow-up in EC, jan 19

PILOT 3: PRODUCT CATEGORY RULES

OBJECTIVE:
Develop the capability of Quality Infrastructure (QI) organizations to offer QI services related to PCRs development according to ISO/TS 14027:2017 in selected LAC countries.

PARTICIPANTS:
ECA (Costa Rica), INTI (Argentina), INMETRO (BRAZIL), ICONTEC (Colombia), TTBS (Trinidad & Tobago)

IMPLEMENTED ACTIVITIES:
- Kick-off workshop on Water Footprint and Quality Infrastructure in November 2017
- Online coaching
- Implementation of action plans of each country
- Capacity building , participation in congresses and related workshops
- Development and technical review of documents and inputs

PLANNED ACTIVITIES:
- Elaborate procedures for PCRs developmet
- PCRs elaboration for specific products
- Diffusion activities of the elaborated products
- Systematization of experiences
- Closing workshop in 2019 (CILCA Costa Rica)

PILOT 5: COLOCATION STUDIES FOR COST-EFFECTIVE AIR MONITORING SENSOR SYSTEMS

OBJECTIVE:
Verify the measurement reliability of cost-effective air monitoring sensors in Latin American and Caribbean Context

PARTICIPANTS:
Argentina (INTI and APrA Buenos Aires, Red Argentina de Monitoreo del Aire) and Costa Rica (Univ. Nacional, USAC and LACOMET) in cooperation with UN Environment.

TIMEFRAME:
August 2017 - July 2019

IMPLEMENTED ACTIVITIES:
- Presentation and Training in Buenos Aires (May 2018)
- Location of sensor in Buenos Aires City

PLANNED ACTIVITIES:
- Location of sensors in Costa Rica and Argentine cities
- Co-location study – comparison of measurement capabilities of cost-effective sensors with conventional monitoring systems
- Systematization of case studies
- Workshop with UN Environment, industry, users and NMIs to share experience

PILOT 6: PROFICIENCY TEST FOR AIR MONITORING NETWORKS

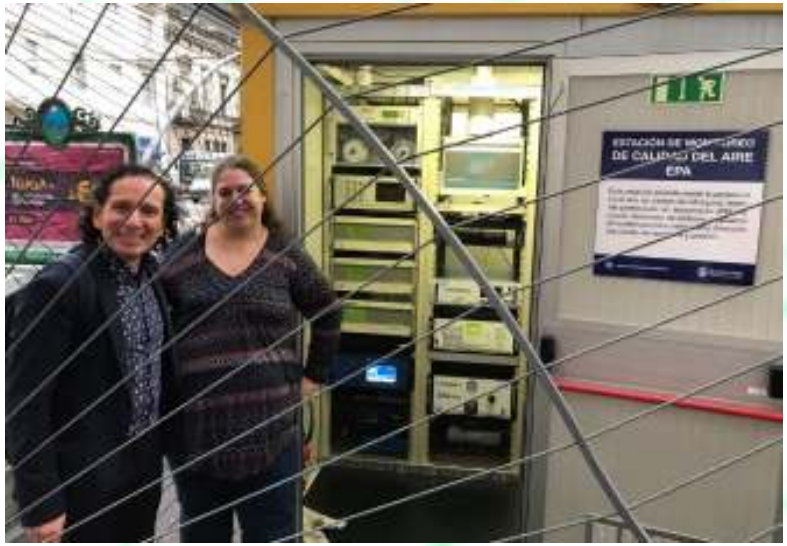
OBJECTIVE:
Improve the measurement capabilities of air monitoring systems in Latin American and Caribbean Cities.

PARTICIPANTS:
Argentina (INTI, APrA Buenos Aires, Red Nacional de Monitoreo del Aire), Brazil (INEA Rio de Janeiro and INMETRO), Costa Rica (Univ. Nacional, USAC and LACOMET), Guatemala (INSIVUMEH), Mexico (Univ. Queretaro y CENAM), Trinidad and Tobago (EMA and TTBS), Paraguay (NMI).

TIMEFRAME:
August 2017 - July 2019

IMPLEMENTED ACTIVITIES:
- Preparatory workshop in Buenos Aires (May 2018)

PLANNED ACTIVITIES:
- Proficiency test in CO
- Follow up workshop and training in measurement uncertainties
- Systematization of case studies



Summary and Outlook

- SIM is supporting metrology for innovation and sustainable development in the Americas building an associative network with its NMIs for working together in common projects
- Good support of funding agencies and partners (IADB, PTB, OAS, NIST)
- New project to develop the metrology needed for the digital economy

Obrigado

Merci

Thank you

Gracias