

IADB SIM Research Engagement Opportunity

2017 Guidance and Application

Activity and Application Guidance

In support of the Sistema Interamericano de Metrología (SIM) Project with the Inter-America Development Bank (IADB) on “Strengthening National Metrology Institutes in the Hemisphere, in support of emerging technologies”, SIM member National Metrology Institutes (NMIs) and Designated Institutes (DIs) are invited to submit joint research proposals to advance development of technical research capabilities in metrology related to emerging technologies such as advanced manufacturing, nanotechnology and biotechnology.

The SIM Technical Committee Chair will accept joint research proposals from any SIM Member NMI or DI that includes at least two SIM partner institutions. All proposals will require management approval, and details on the objectives and benefits of each activity. The application may be found on Page 2 of this document.

Project requests may not exceed US\$ 45,000. The requested funds can be used to support exchange of scientists, organize meetings, workshops, intercomparisons and pilot studies.

Proposals shall be sent to SIM Technical Committee Chair (csanto@latu.org.uy) with copy to SIM Secretariat (Simkin@inti.gob.ar).

Application and Administrative Review Timeline

The table below includes both deadlines for applicants and other important dates that should be kept in mind when preparing associated activity arrangements.

Application Processing	Important dates & Deadlines (see explanation below) ¹
Application Announcement	26 th December 2016
Application Deadline (<i>all applications</i>)	3 th March 2017
Applicant(s) Notified of Final Decision	10 th April 2017

Selection Criteria:

Applications will be evaluated based on need and potential impact.

Contribution to IADB project goals (see project goals at the end of this document)

Contribution to addressing measurement challenges associated with emerging technology

New collaboration or continuation or expansion of existing collaboration.

Benefit to partners and to region

Number of countries (minimum 2)

Application

Please do not exceed two pages.

Partner Institutions (include PI, email and address for each NMI)	<ul style="list-style-type: none">- NIST (National Institute of Standards and Technology). PI: Akobuije Chijioko (ako.chijioko@nist.gov), Nicholas Vlajic (nicholas.vlajic@nist.gov), Ricky Seifarth (ricky.seifarth@nist.gov), 100 Bureau Drive, Gaithersburg, MD, 20889, USA.- INMETRO (Instituto Nacional de Metrologia, Qualidade e Tecnologia). Rafael Oliveira (rsolveira@inmetro.gov.br), Renato Machado (rrmachado@inmetro.gov.br), Claudio A. Koch (cakoch@inmetro.gov.br). Avenida Nossa Senhora das Graças, 50 Prédio 3 (Mecânica), Xerém, Duque de Caxias– RJ – Brazil- INTI (Instituto Nacional de Tecnología Industrial). Alejandro Savarin (asavarin@inti.gob.ar), Ramiro Benevenia (ramirob@inti.gob.ar), María Mingolla (mingolla@inti.gob.ar), Marcos Bierzychdek (marcosb@inti.gob.ar). Av. General Paz 5445, 1650, San Martín, Buenos Aires, Argentina.
Project Description <i>Briefly describe the research project, highlighting key objectives and expected contributions of each of the partners</i>	<p>Most industrial measurements of force are performed dynamically, while calibrations are performed almost exclusively in static form. It is evident that the dynamic responses of the instruments are very different from the static form.</p> <p>Once the demands of the design of products, machines or process are improved in the industry, the force measurement tolerances become narrower, so there is less condition to disregard the differences between the behaviors of the instrument in the static regime and in the dynamic regime. The NMIs in this project have been requested from the industry to better quantify and purpose solutions to this gap in the metrological traceability, mainly from automotive, oil, energy and aerospace sectors. The demand is mainly characterized for fatigue testing machines, but requirements for dynamic measurements on specific production equipment, such as robotic assembly, process control and machining forces are constantly increasing.</p> <p>Main objectives are:</p> <ul style="list-style-type: none">- Understand the behavior of the equipment, parts under test and the involved traceability in order to advise the industry on how to perform/improve the measurement and how to select the appropriate instruments, focusing in the metrological reliability.- Interact with regional industry and productivity arrangements, research centers and universities, so as to link academic knowledge with production processes through metrology.- Develop secondary and primary standards based both on physical-mathematical models. Traceability at the regional level will allow accredited laboratories to have their own secondary standards and/or perform calibrations of testing machines dynamically. <p>Three key topics will be studied together: a) Physical models and measurements in industrial environment; b) Secondary standards and their associated instruments, and c) Primary standards and their implementation.</p> <p>The exchange will firstly be through e-mails and online meetings in order to analyze the methodology and materials such as necessary instruments, equipment to be design, data to be obtained from measurements, FEM simulation, etc. There will be up to three brief training stays in the institutes involved to carry out pilot measurements and analyze data obtained and other issues that need to be solved in situ.</p> <p>At the end of this project, it is expected to hold a workshop for all SIM members where this knowledge can be transferred and the new steps on the theme are to be discussed for the region.</p>

	<p>A SIM guide on good measurement practices will be produced in addition to the EURAMET guide “<i>Industrial Dynamic Measurements: A Best Practice Guide</i>”.</p> <p>NIST's contribution will be mainly its experience in the development of primary standards for the dynamic calibration of force sensors.</p> <p>INMETRO will mainly contribute with their experience acquired with the practices carried out in secondary systems and with the research on the standard ISO 4965-1. The NMI had also started developing measurements in the primary method.</p> <p>INTI started some theoretical studies on the use of specific sensors under dynamic regimes and the limitations for the direct application of static traceability to these conditions.</p> <p>All NMIs will contribute with their expertise through the much interdisciplinary work that this project requires, including topics like mechanical design, instrumentation, data acquisition and statistical analysis.</p>
<p>Potential impact/project goals: <i>briefly describe the measurement challenge this research project is expected to address</i></p>	<p>Dynamic measurements in this magnitude require very specific knowledge regarding movement mechanics and structural, physical-mathematical models and the use of specific equipment such as laser interferometers, high speed synchronized reading, etc., what makes this an interdisciplinary project where force, vibration, optics and electronics are involved.</p> <p>The equipment is very specific and the force and movement input sources rely on a) fatigue machines for secondary standards and; b) electrodynamic shakers for primary standards.</p> <p>a) In the first case it is necessary to know and characterize all the accessories that are part of the load train of the fatigue machines. The adopted ranges of forces, frequencies and mechanical compliances are the elements that will characterize and envelop the conditions for the calibration. Dynamic and inertial compensation must be applied in order to isolate the existing dynamic efforts and define the quantities to be used as references, what makes it necessary to measure various displacements and deformations of the components involved, accelerometers and laser interferometers can be used for this purpose. Experiments show there must be a cost benefit analysis for the data acquisition adjustments according to the frequency range.</p> <p>b) In the case of primary standards, it is necessary to measure the acceleration of its table and the standard weight that is placed over the transducer, accelerometers and laser interferometers are used for this purpose. It is necessary to know the phase difference between the response signal and the mechanical excitation, which is why the synchronization and the dynamic characterization of the digital amplifiers are fundamental. The movement should be only vertical, but there are superimposed horizontal movements that need to be known. In primary standards the main source of uncertainty is given by the rocking motion of the weight. Structurally, the transducer can be modeled as one or more material points, each with its inertia, elasticity and damping, information that needs to be determined empirically. Mounting the instrument is critical and substantially modifies the natural frequencies of the system, another of the variables to be determined.</p>
<p>Project relevance: <i>briefly describe the relevance of the project to IADB/SIM Project Goals</i></p>	<p>NIST, INTI and INMETRO recently started the developments for dynamic measurements in force and other mechanical quantities and this project aims to combine efforts in this issue and transfer the results to the SIM members.</p> <p>Dynamic measurements have a very strong conceptual component, making it possible for the SIM institutes that still do not have developed equipment also to improve their current measurement capabilities and develop R&D activities with direct application.</p> <p>The emerging technologies associated with the previously mentioned sectors in the industry, according to these issues, will be based on more accurate and reliable traceability.</p>

New or Existing Collaboration <i>briefly explain is this is a new collaboration? or an extension or expansion of existing collaboration?</i>	While there were and there are several collaborative projects among the NMIs part of this project, collaboration in the specific area of force is new.
Tentative Dates <i>Expected start and end dates</i>	From July 2017 until December 2018.
Project cost <i>Please provide an estimated cost(NTE 40K)</i>	About U\$S 44.000.-

Please describe:

Benefit to SIM:

The development to be carried out will be transferred to the SIM members through guides of good measurement practices, scientific publications and in a workshop to be held at the end of this project. Regional demand for counseling and measurements will be met.

Benefit to Participating Metrology Institute(s):

In the case of INTI and INMETRO, NIST support and work together seek to develop secondary and primary standards to meet the regional demand for dynamic measurements. In all NMIs including NIST, it is expected that the secondary equipment developed will be useful in disseminating dynamic force to local customers and calibration laboratories.

Anticipated results/impact:

- NMIs will be able to assist industry in subjects related to dynamic measurements; in most cases with counseling and in the NMIs part of this project, also the realization of SI traced measurements and calibrations.
- Is expected improvements in the quality of industrial processes (productivity, lower scrap, longer machine life, etc.), and the quality of products (fault analysis, tolerance reduction, etc.).
- The development of secondary calibration systems will allow the dynamic calibration of many of the instruments that other laboratories and industries nowadays calibrate statically.
- The development of primary standards will allow, the traceability to the SI within SIM.

Objectives of SIM-IADB Project. *The General Objective is: Development and implementation of new measurement expertise available in member countries to address emerging technology needs. The three specific objectives: (i) Promote a climate of innovation, competitiveness and productivity by enhancing the delivery of advanced measurement services needed by firms for the development and adoption of emerging technologies; (ii) Facilitate public-private sector dialogue between the national measurement institutes and stakeholders in government and industry to improve the regulatory framework in the hemisphere needed to develop innovative companies bringing new products and technologies to the marketplace; and (iii) Promote the mutual acceptance of measurement results necessary not only for trade, but also to facilitate cooperative R&D projects between different member countries, and between LAC and other regions.*