# EURAMET-ovi EMPIR projekti

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14. Konferencija o mjeriteljstvu i akreditaciji
Zagreb, 28. svibnja 2019.

# Sadržaj

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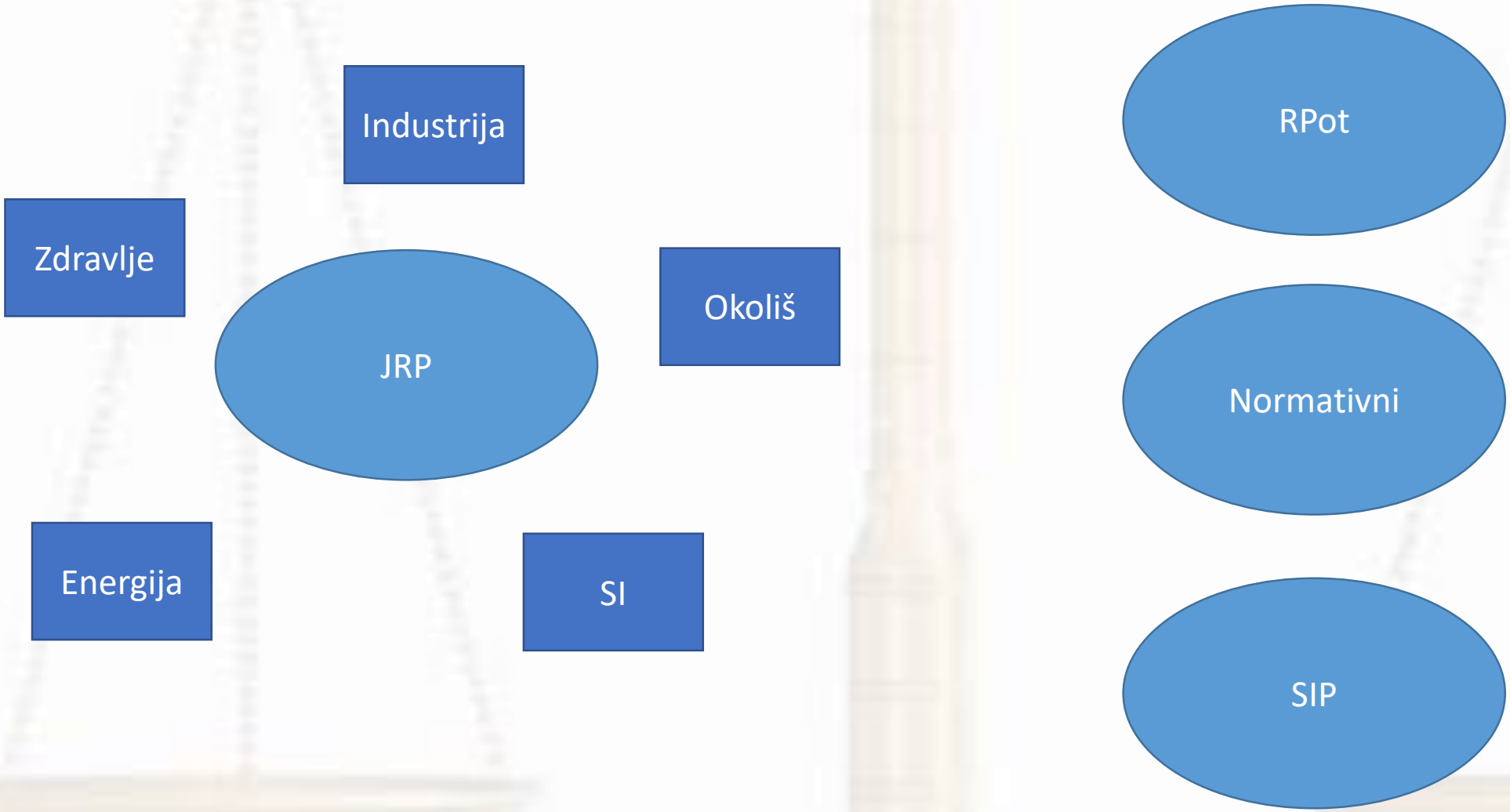
# Uvod

EMPIR = European Metrology Programme for Innovation and Research

- dio EU programa za istraživanje i inovacije Horizon 2020
- 2014 – 2020
- 600 M€ (300 M€ zemlje članice + 300 M€ Europska komisija)
- 2014 – 2018: 169 projekata

# Tipovi projekata



# Ciljani programi

Zdravlje

- pouzdano, usporedivo i učinkovito korištenje dijagnostike i terapije
- razvoj novih tehnika u zdravstvu, ograničenje troškova, poticanje kompetitivnosti

Energija

- Uvođenje poboljšanja za stabilnost energetskog sustava
- Predviđanje promjena u ponudi i potražnji, smanjivanje ograničenja pri trgovini i uvođenje raznih vrsta energije u distribuciju
- Podrška transformaciji električne i plinske mreže u tzv. „pametne mreže”

# Ciljani programi

Okoliš

- robusna i stabilna mjerenja za praćenje klimatskih promjena
- inovativni sustavi i tehnologije za utvrđivanje utjecaja na okoliš

Industrija

- razvoj novih instrumenata i metoda za stavljanje na tržište
- cilj: unapređenje kompetitivnosti europske industrije

Temeljno mjeriteljstvo

- bliska suradnja NMI-a, sveučilišta i istraživačkih institucija

# Ciljani programi

## Standardizacija

- istraživanje kao podrška razvoju međunarodnih normi s ciljem:
  - povećanja kompetitivnosti industrije
  - omogućavanje i olakšavanje trgovine za nove proizvode, usluge i tehnologije
  - znanstvena potpora pri donošenju regulativa povezanih s klimatskim promjenama, očuvanjem okoliša i zdravlja ljudi i zaštitom potrošača

# Ciljani programi

Potencijal za istraživanje (Research Potential)

- koherentan, učinkovit, održiv i integrirani razvoj europskog mjeriteljstva kroz poticanje istraživanja u slabije razvijenim NMI-ima

Diseminacija

- dalje korištenje rezultata završenih zajedničkih istraživačkih projekata (JRPs)
- utjecaj izvan mjeriteljske zajednice:
  - doprinos normama i regulativnim procesima
  - prijenos znanja ili tehnologije kao podrška inovacijama

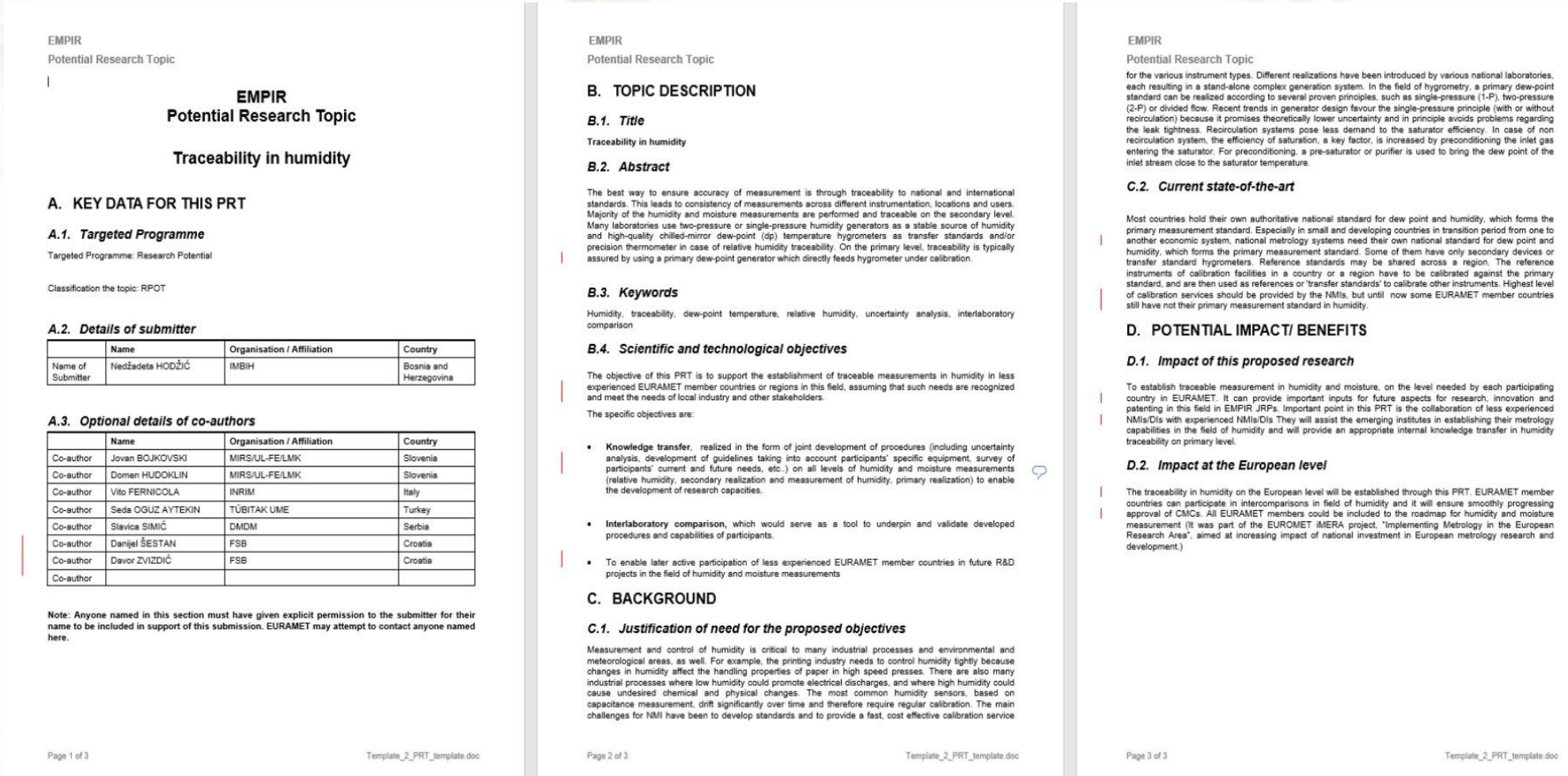
# Proces prijave

$PRT_1$

$PRT_2$

...

$PRT_n$



EMPIR
Potential Research Topic

**EMPIR**
**Potential Research Topic**

**Traceability in humidity**

## A. KEY DATA FOR THIS PRT

### *A.1. Targeted Programme*

Targeted Programme: Research Potential

Classification the topic: RPOT

### *A.2. Details of submitter*

| | Name | Organisation / Affiliation | Country |
|---|---|---|---|
| Name of Submitter | Nedžadeta HODŽIĆ | IMBIH | Bosnia and Herzegovina |

### *A.3. Optional details of co-authors*

| | Name | Organisation / Affiliation | Country |
|---|---|---|---|
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| Co-author | Danijel ŠESTAN | FSB | Croatia |
| Co-author | Davor ZVIZDIĆ | FSB | Croatia |
| Co-author | | | |

**Note: Anyone named in this section must have given explicit permission to the submitter for their name to be included in support of this submission. EURAMET may attempt to contact anyone named here.**

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## B. TOPIC DESCRIPTION

### *B.1. Title*

**Traceability in humidity**

### *B.2. Abstract*

The best way to ensure accuracy of measurement is through traceability to national and international standards. This leads to consistency of measurements across different instrumentation, locations and users. Majority of the humidity and moisture measurements are performed and traceable on the secondary level. Many laboratories use two-pressure or single-pressure humidity generators as a stable source of humidity and high-quality chilled-mirror dew-point (dp) temperature hygrometers as transfer standards and/or precision thermometer in case of relative humidity traceability. On the primary level, traceability is typically assured by using a primary dew-point generator which directly feeds hygrometer under calibration.

### *B.3. Keywords*

Humidity, traceability, dew-point temperature, relative humidity, uncertainty analysis, interlaboratory comparison

### *B.4. Scientific and technological objectives*

The objective of this PRT is to support the establishment of traceable measurements in humidity in less experienced EURAMET member countries or regions in this field, assuming that such needs are recognized and meet the needs of local industry and other stakeholders.

The specific objectives are:

- **Knowledge transfer**, realized in the form of joint development of procedures (including uncertainty analysis, development of guidelines taking into account participants' specific equipment, survey of participants' current and future needs, etc..) on all levels of humidity and moisture measurements (relative humidity, secondary realization and measurement of humidity, primary realization) to enable the development of research capacities.
- **Interlaboratory comparison,** which would serve as a tool to underpin and validate developed procedures and capabilities of participants.
- To enable later active participation of less experienced EURAMET member countries in future R&D projects in the field of humidity and moisture measurements

## C. BACKGROUND

### *C.1. Justification of need for the proposed objectives*

Measurement and control of humidity is critical to many industrial processes and environmental and meteorological areas, as well. For example, the printing industry needs to control humidity tightly because changes in humidity affect the handling properties of paper in high speed presses. There are also many industrial processes where low humidity could promote electrical discharges, and where high humidity could cause undesired chemical and physical changes. The most common humidity sensors, based on capacitance measurement, drift significantly over time and therefore require regular calibration. The main challenges for NMI have been to develop standards and to provide a fast, cost effective calibration service

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EMPIR
Potential Research Topic

for the various instrument types. Different realizations have been introduced by various national laboratories, each resulting in a stand-alone complex generation system. In the field of hygrometry, a primary dew-point standard can be realized according to several proven principles, such as single-pressure (1-P), two-pressure (2-P) or divided flow. Recent trends in generator design favour the single-pressure principle (with or without recirculation) because it promises theoretically lower uncertainty and in principle avoids problems regarding the leak tightness. Recirculation systems pose less demand to the saturator efficiency. In case of non recirculation system, the efficienoy of saturation, a key factor, is increased by preconditioning the inlet gas entering the saturator. For preconditioning, a pre-saturator or purifier is used to bring the dew point of the inlet stream close to the saturator temperature.

### *C.2. Current state-of-the-art*

Most countries hold their own authoritative national standard for dew point and humidity, which forms the primary measurement standard. Especially in small and developing countries in transition period from one to another economic system, national metrology systems need their own national standard for dew point and humidity, which forms the primary measurement standard. Some of them have only secondary devices or transfer standard hygrometers. Reference standards may be shared across a region. The reference instruments of calibration facilities in a country or a region have to be calibrated against the primary standard, and are then used as references or 'transfer standards' to calibrate other instruments. Highest level of calibration services should be provided by the NMIs, but until now some EURAMET member countries still have not their primary measurement standard in humidity.

## D. POTENTIAL IMPACT/ BENEFITS

### *D.1. Impact of this proposed research*

To establish traceable measurement in humidity and moisture, on the level needed by each participating country in EURAMET. It can provide important inputs for future aspects for research, innovation and patenting in this field in EMPIR JRPs. Important point in this PRT is the collaboration of less experienced NMIs/DIs with experienced NMIs/DIs They will assist the emerging institutes in establishing their metrology capabilities in the field of humidity and will provide an appropriate internal knowledge transfer in humidity traceability on primary level.

### *D.2. Impact at the European level*

The traceability in humidity on the European level will be established through this PRT. EURAMET member countries can participate in intercomparisons in field of humidity and it will ensure smoothly progressing approval of CMCs. All EURAMET members could be included to the roadmap for humidity and moisture measurement (It was part of the EUROMET iMERA project, "Implementing Metrology in the European Research Area", aimed at increasing impact of national investment in European metrology research and development.)

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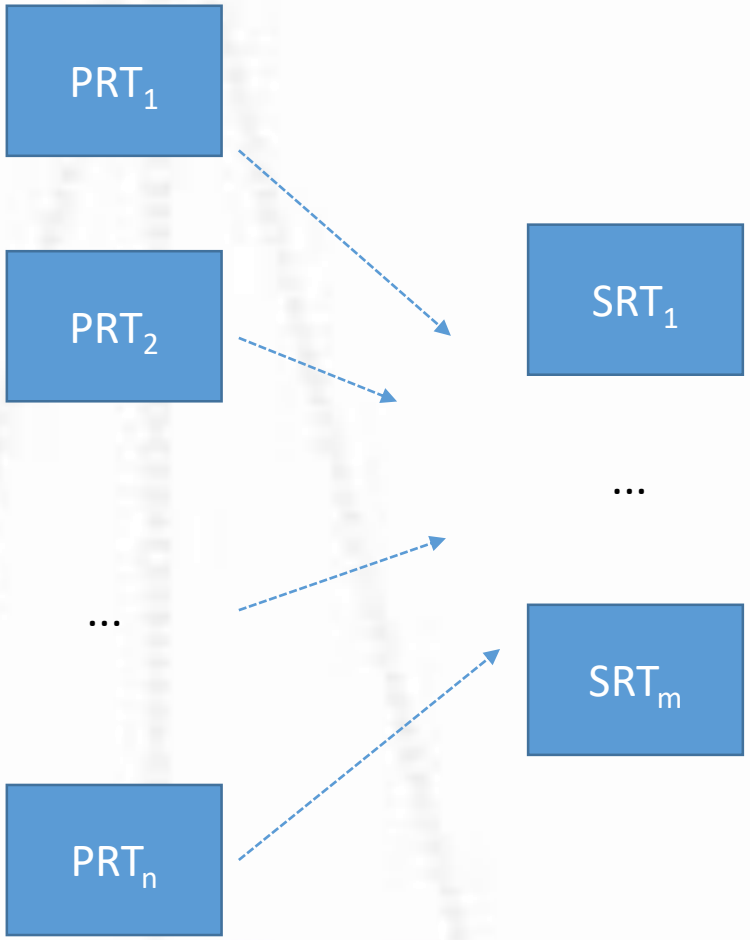
# Proces prijave




**EMPIR Call 2014 – Industry and Research Potential**

Selected Research Topic number: **SRT-i29**
Version: 1.0

EURAMET
European Association of National Metrology Institutes

## Title: Industrial temperature measurement: quantitative thermal imaging

### Abstract

Thermal imaging is the fastest growing sector of the world temperature sensing market and is becoming a widely used technique for quantitative temperature measurement and non-destructive testing in a large cross section of industrial fields like aerospace, construction, chemistry, healthcare, manufacturing process control and material processing. It is predicted that the thermal imager market will continue growing: it already represents 4bn € and increases at a yearly rate of about 10 %. It is the responsibility of the metrology institutes to help set up adapted measurement, characterisation and calibration means and methods to assist industrial stakeholders using or manufacturing thermal imagers over a wide temperature range.

### Keywords

Temperature, thermal imaging, infrared, surface temperature, aeronautic industry, non-destructive testing, calibration, emissivity, characterisation.

### Background to the Metrological Challenges

Thermal imaging is a rapidly developing technology for temperature measurement. It has a huge potential but this is currently limited by poor temperature performance and insufficiently understood uncertainty sources. For example, currently in the low-temperature range thermal imagers suffer from large uncertainties (in the order of 1 % to 2 %); and in the high temperature range 200 to 1800 °C, measurements suffer from a number of uncertainties related to calibration to SI units via secondary standards.

Thermal imaging in the low temperature region is the most used technique in safety, non-destructive testing, building energy efficiency assessment, medical thermography, preventive/predictive maintenance. Even if the temperature evolution in time is usually sought, some applications require absolute temperature measurement with a low uncertainty. For other industrial or medical applications high thermal and high spatial uniformity are required to distinguish hidden defects or anomalies with equivalent temperature differences in the image in the order of 0.1 °C. Moreover factors like the response time of the measuring device, in case of fast detection, and the thermophysical characteristics of the target material(s) will need to be accounted for in the assessment of the uncertainty budgets.

In metallurgy many processes like soldering and roll plating suffer from difficult temperature measurement, as the emissivity varies largely during the process. Especially for high reflecting metals, like Al or Cu, a stable temperature measurement is practically impossible due to changes of surface quality during the process (roughness, oxidation). The result is that the process tuning is usually achieved by multiple tests oriented to the empirical optimisation of the process results (and to large waste rates). The application of thermal imaging systems would reduce the optimisation time significantly, if the thermal image represents the surface true temperatures. The difficulties are quite similar in the glass and semiconductor industries in which remote temperature measurements are necessary and emissivity unknown.

### Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the proposal.

The JRP shall focus on the traceable measurement and characterisation of temperature measurements in industrial applications.

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The specific objectives are

1. To measure traceable temperatures using thermal imagers at low temperatures (below 120 °C) in an industrial and medical settings and to develop common approach towards standardisation and uncertainty analysis.
2. To develop validated techniques for quantitative thermal imaging using radiation thermometry methods in the range 200 °C to 1800 °C applied to highly reflective surfaces.
3. To develop validated bi-chromatic or multispectral thermal imaging techniques for use in industry.
4. To develop characterisation and calibration methods for use with high temperature thermal imaging with CCD or CMOS type thermal imagers (above 800 °C).
5. To ensure that the outputs from the JRP are effectively disseminated to and exploited by industry using thermal imagers. To facilitate the take up of the technology and measurement infrastructure developed by the project, and to support the development of new, innovative products and thereby enhance the competitiveness of EU industry.

Proposers shall give priority to work that meets documented industrial needs and include measures to support transfer into industry by cooperation and by standardisation. An active involvement of industrial stakeholders is expected in order to align the project with their needs – both through project steering boards and participation in the research activities.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this. In particular, proposers should outline the achievements of the EMRP JRPs IND01 HiTeMS, and IND13 T3D and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs to be 1.5 M€, and has defined an upper limit of 1.8 M€ for any project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution to the project. Any deviation from this must be justified.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

### Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the "end user" community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the "end user" community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Drive innovation in industrial production and facilitate new or significantly improved products through exploiting top-level metrological technology,
- Improve the competitiveness of EU industry,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the temperature measurement sector.

You should detail other impacts of your proposed JRP as specified in the document "Guide 4: Writing Joint Research Projects"

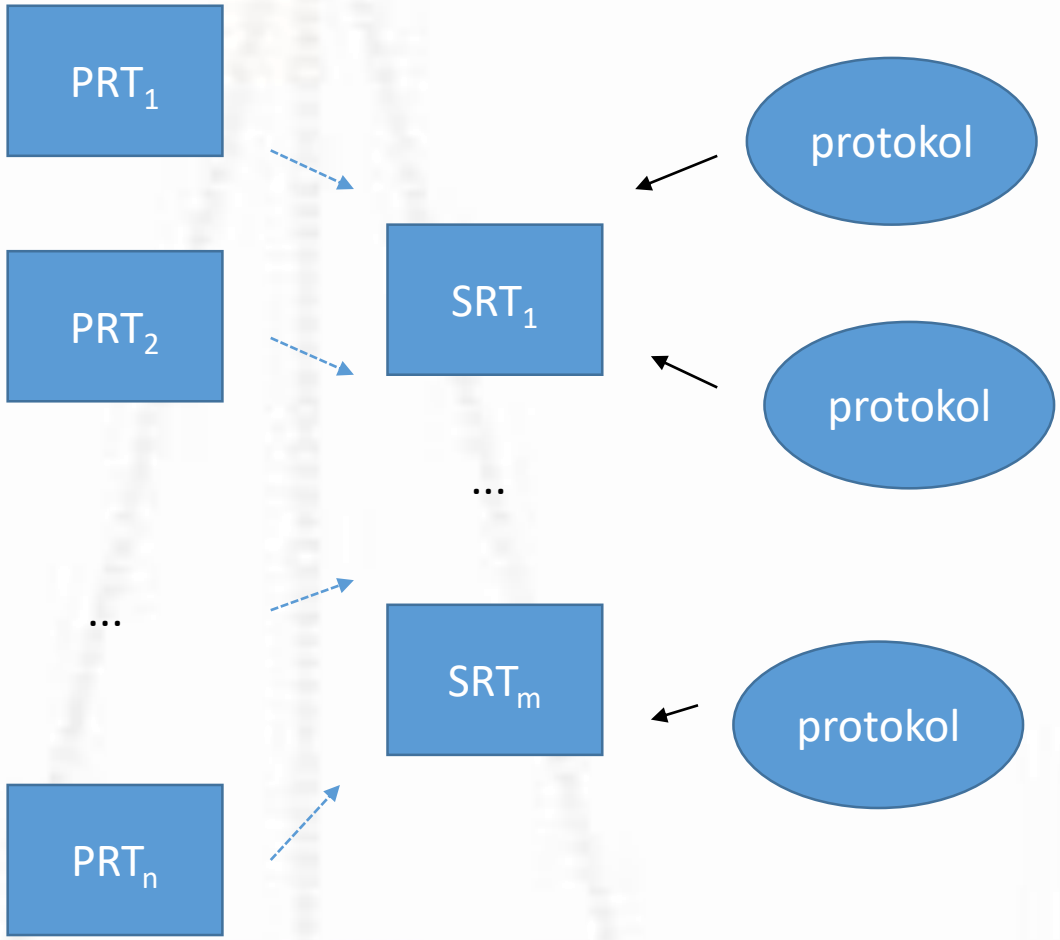
You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

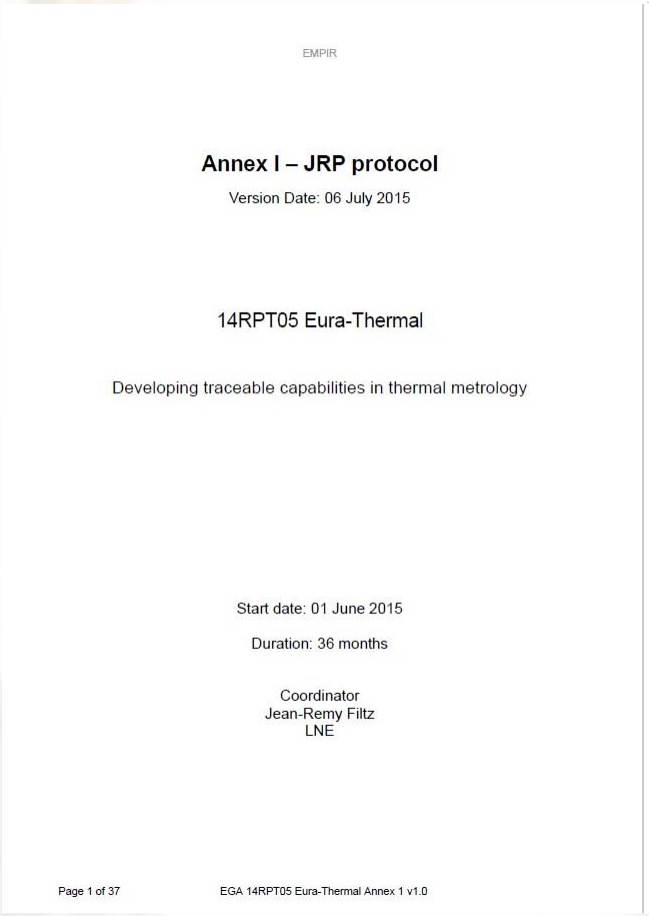
- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

### Time-scale

The project should be of up to 3 years duration.

# Proces prijave



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**Annex I – JRP protocol**

Version Date: 06 July 2015

14RPT05 Eura-Thermal

Developing traceable capabilities in thermal metrology

Start date: 01 June 2015

Duration: 36 months

Coordinator
Jean-Remy Filtz
LNE

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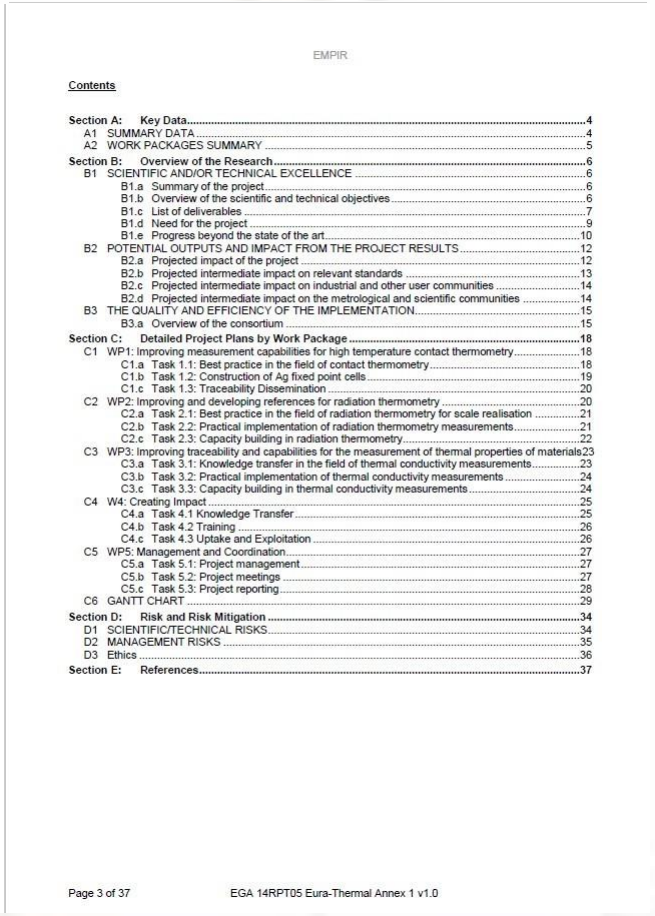

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# Proces prijave

Projekt 1

Projekt 2

...

Projekt k



**GRANT AGREEMENT**

**FOR EUROPEAN METROLOGY PROGRAMME FOR INNOVATION AND RESEARCH (EMPIR)[1]**

**NUMBER: 14RPT05 Eura-Thermal**

This **Agreement** ('the Agreement') is **between** the following parties:

**on the one part,**

**EURAMET e.V, Bundesallee 100, 38116 Braunschweig, Germany,**

**and**

**on the other part,**

1. 'the coordinator':

Laboratoire national de métrologie et d'essais (LNE), official registration no. 313320244, established in 1 rue Gaston Boissier, FR-75724 Paris Cedex 15, France, VAT no. FR92313320244 as 'National Metrology Institute' (NMI).

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

2. Cesky Metrologicky Institut Brno (CMI), official registration no. 177016, established in Okružní 31, CZ-638 00 Brno, Czech Republic, VAT no. CZ00177016 as 'National Metrology Institute' (NMI).

3. Conservatoire national des arts et metiers (CNAM), official registration no. 197534712, established in 292 rue Saint-Martin, FR-75141 Paris Cédex 03292, France, VAT no. FR11197534712 as 'Designated Institute' (DI).

4. Sveuciliste U Zagrebu, Fakultet Strojarstva I Brodogradnje (FSB), official registration no. 80365931, established in Ivana Lucica 5, 10000, Zagreb, Croatia, VAT no. HR22910368449 as 'Designated Institute' (DI).

5. Institut za mjeriteljstvo Bosne i Hercegovine (IMBiH), official registration no. CF4201178930001, established in Augusta Brauna 2, BA-71000 Sarajevo, Bosnia and Herzegovina, as 'National Metrology Institute' (NMI).

6. Magyar Kereskedelmi Engedelyezesi Hivatal (MKEH), established in Németvölgyi út 37-39, HU-1124 Budapest XII, Hungary, VAT no. HU15329657 as 'National Metrology Institute'

[1] Decision no 555/2014/EU of the European parliament and of the Council of 15 May 2014 on the participation of the Union in a European Metrology Programme for Innovation and Research (EMPIR) jointly undertaken by several Member States (OJ L 169/27,7.6.2014)





(NMI).

7. Ministry of Economy (MoE), official registration no. 17862154, established in Kneza Milosa 20, RS-11000 Belgrade, Serbia, VAT no. RS108213421 as 'National Metrology Institute' (NMI).

8. National Standards Authority of Ireland (NSAI), established in 1 Swift Square, Northwood, Santry, Dublin 9, Ireland, VAT no. IE9586652U as 'National Metrology Institute' (NMI).

9. Turkiye Bilimsel ve Teknolojik Arastirma Kurumu (TUBITAK), official registration no. 278, established in Ataturk Bulvari 221, TR-06100 Ankara, Turkey, VAT no. TR1750003600 as 'National Metrology Institute' (NMI).

10. Univerza v Ljubljani (UL), official registration no. 5085063, established in Kongresni trg 12, SI-1000 Ljubljana, Slovenia, VAT no. SI54162513 as 'Designated Institute' (DI).

11. Institut Za Nuklearne Nauke Vinca (VINCA), official registration no. 660-02-00249/93-02, established in Mihajla Petrovica Alasa 12-14 , 11001, Belgrade, Serbia, VAT no. PID101877940 .

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator.
The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form, the beneficiaries accept the grant and agree to implement the action under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.

The Agreement is composed of:

Terms and Conditions

| | |
|---|---|
| Annex 1 | Description of the action |
| Annex 2 | Estimated budget for the action |
| Annex 3 | Accession Forms |
| Annex 4 | Model for the financial statements |
| Annex 5 | Model for the certificate on the financial statements |
| Annex 6 | Model for the certificate on the methodology |
| Annex 7 | Model for the technical reports |

**TERMS AND CONDITIONS**

# Proces prijave – timeline

1. PRT–ovi: veljača
2. SRT–ovi: lipanj
3. sastanak partnera: kraj lipnja/početak srpnja
4. protokol i budžet: kraj rujna/početak listopada
5. sastanak s recenzentima: početak studenog
6. odobreni projekti: siječanj
7. početak projekta: 1. lipnja

# RH projekti

| Polje | Naziv | NUL | poziv |
|---|---|---|---|
| IND | Advanced Computed Tomography for dimensional and surface measurements in industry | FSB-LPMD | 2017 |
| RPOT | A digital traceability chain for AC voltage and current | FER-PEL | 2017 |
| RPOT | Research capabilities for radiation protection dosimeters | IRB-SSDL | 2017 |
| ENV | Metrology for mobile detection of ionising radiation following a nuclear or radiological incident | IRB-SSDL | 2016 |
| RPOT | Traceability routes for electrical power quality measurements | FER-PEL | 2015 |
| RPOT | Expansion of European research capabilities in humidity measurement | FSB-LPM | 2015 |
| RPOT | Towards the propagation of ac quantum voltage standards | FER-PEL | 2014 |
| RPOT | Absorbed dose in water and air | IRB-SSDL | 2014 |
| RPOT | Developing traceable capabilities in thermal metrology | FSB-LPM | 2014 |

# 2020

| Poziv | M€ | NMI |
|---|---|---|
| Industrija | 15 | 70% |
| Temeljno mjeriteljstvo | 16 | 60% |
| Normativni | 5 | 70% |
| Potencijal za istraživanje | 9 | 100% |
| Diseminacija | 0.5 | 100% |

https://msu.euramet.org/calls.html

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Hvala na pažnji!

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