



"HORIA HULUBEI" NATIONAL  
INSTITUTE FOR R&D IN PHYSICS  
AND NUCLEAR ENGINEERING  
(IFIN-HH)



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DEPARTMENT OF RADIOISOTOPES AND RADIATION METROLOGY

# IONISING RADIATION METROLOGY

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# IONISING RADIATION METROLOGY IN IFIN-HH...

- Activity – Bq (Radionuclides Metrology Laboratory)
  - primary and national activity standard, directly traceable to BIPM;
  - member within BIPM's Consultative Committee for Ionising Radiation (CCRI);
- Dosimetry - Gy, Gy/h, Sv, Sv/h (Dosimetry Group)
  - secondary standard dosimetry laboratory (SSDL) traceable to PTB (Germany);
  - ultra low level background dosimetry capabilities at Slanic-Prahova (underground salt mine);
- Both Laboratories:
  - establishing the national metrological traceability chain and its international equivalence (calibration of equipment and participating to international comparisons - CMCs);
  - accredited according to ISO17025 by RENAR (Romanian Accreditation Association - National Accreditation Body);
  - participating to national and international metrology research projects;
  - for the ionising radiation metrology field, IFIN-HH is Designated Institute (DI) in the frame of EURAMET (the European Association of National Metrology Institutes);

# EURAMET IS...

- the Regional Metrology Organisation (RMO) of Europe;
- the other Worldwide RMOs in cooperation with EURAMET:
  - SIM (Inter-American Metrology System);
  - COOMET (Euro-Asian Cooperation of National Metrological Institutions);
  - GULFMET (Gulf Association for Metrology GULFMET);
  - APMP (Asia Pacific Metrology Programme);
  - AFRIMETS (Intra-Africa Metrology System);

## ITS MISSION IS ...

- to develop and disseminate an integrated, cost effective and internationally competitive measurement infrastructure for Europe;
- to always take into account the needs of industry, business and governments;
- to meet the national requirements of its members and to establish a balanced European measurement infrastructure;
- to enhance benefits of metrology to society;

## ITS MEMBERS ARE ...

- National Metrology Institutes (NMIs) of member states of the European Union: 37

(NATIONAL METROLOGY INSTITUTE OF ROMANIA – different fields of metrology)

- Designated Institutes (DIs) from states with a member: 78

(“HORIA HULUBEI” NATIONAL INSTITUTE FOR R&D IN PHYSICS AND NUCLEAR ENGINEERING – radioactivity)

# EURAMET OBJECTIVES ARE ...

- to understand and prioritise investment in the European measurement infrastructure to address the present and future priorities of business and society;
- to develop key partnerships;
- to understand stakeholder needs;
- to increase the impact of metrology to society;
- to anticipate market and needs trends based on foresight analysis;

# PAN-EUROPEAN RESEARCH COLLABORATIONS ...

- EURAMET has been successful in working with the European Commission and great number of the National Governments of member countries in developing:
- 2009-2013 European Metrology Research Programme (EMRP):  
119 research projects funded (400 M€)
- 2014-2020 European Metrology Programme for Innovation and Research (EMPIR):  
... similar targets ...

# IFIN-HH WITHIN EMRP&EMPIR ...

- 2010 - 2013 "Metrology for New Generation Nuclear Power Plants" (MetroFission);
- 2011 - 2014 "Ionising Radiation Metrology for the Metallurgical Industry" (MetroMETAL);
- 2014 - 2017 "Metrology for Decommissioning Nuclear Facilities" (MetroDecom);
- 2014 - 2017 "Metrology for Radiological Early Warning Networks in Europe" (MetroERM);
- 2015 - 2017 "Absorbed Dose in Water and Air" (MetroABSORB);
- 2017- 2020 "Metrology for Radon Monitoring" (MetroRADON);



# METROFISSION: "METROLOGY FOR NEW GENERATION NUCLEAR POWER PLANTS"

- [Call](#): "Energy";
- [Partners \(11\)](#): CEM (Spain); CIEMAT (Spain); CMI (Czech Republic); ENEA-INMRI (Italy); **IFIN-HH (Romania)**; LNE (France); LNE-INM (France); LNE-LNHB (France); NPL (United Kingdom); PTB (Germany); SMU(Slovakia);
- [Project responsible](#): Dr. Aurelian LUCA (aluca@nipne.ro);
- [Duration](#): 2010-2013;
- [Scope](#): Metrology support for energy supplies that are secure, sustainable and of high quality;
  
- [Results](#):
  - the improvement of measurement techniques for radioactivity for safe and efficient operation of new nuclear power plants;
  - the improvement of metrology for determination of high-energy neutron cross sections;
  - the obtain of new sets of nuclear data for the fuel cycle of new nuclear power plants;
  - the obtain of important data regarding the thermal energy released in the reactor core from minor actinides present in the fuel;

# METROMETAL: "IONISING RADIATION METROLOGY FOR THE METALLURGICAL INDUSTRY"

- [Call](#): "Industry";
- [Partners \(13\)](#): BEV (Austria); BFKH (Hungary); CIEMAT (Spain); CMI (Czech Republic); ENEA-INMRI (Italy); **IFIN-HH (Romania)**; IST/LPSR (Portugal); LNE-LNHB (France); MIRS/IJS/F-2,O-2 (Slovenia); POLATOM (Poland); PTB (Germany); SMU (Slovakia); STUK (Finland);
- [Project responsible](#): Dr. Maria SAHAGIA (msahagia@nipne.ro);
- [Duration](#): 2011-2014;
- [Scope](#): Metrology support to establish common standards for radioactivity monitoring in steelworks;
  
- [Results](#):
  - the development of SI-traceable methods optimised for the measurement of radioactivity at steelworks;
  - the design and validation of prototype gamma-ray spectrometric devices based on Ge detectors and BeCr3 scintillators;
  - the recommendation of the best alternative to the current measurement systems used in industry to measure the activity;

# METRODECOM: "METROLOGY FOR DECOMMISSIONING NUCLEAR FACILITIES"

- [Call](#): "Environment";
- [Partners \(10\)](#): CMI (Czech Republic); ENEA-INMRI (Italy); **IFIN-HH (Romania)**; LNE (France); LNE-LNHB (France); MIKES (Finland); NPL (United Kingdom); PTB (Germany); SCK-CEN/LNK (Belgium); STUK (Finland);
- [Project responsible](#): Dr. Doru STANGA (doru@nipne.ro);
- [Duration](#): 2014-2017;
- [Scope](#): Metrology support to the decommissioning of nuclear facilities;
  
- [Results](#):
  - the development of methods for the radionuclide characterisation of different types of materials present on the site being decommissioned;
  - the development of traceable methods for the pre-selection of waste materials prior to measurement for repository acceptance or possible free release;
  - the development of methods for monitoring in radioactive waste repositories;
  - the development of reference materials and standard sources for calibration, validation and testing of devices, instruments and developed procedures;

# METROERM: "METROLOGY FOR RADIOLOGICAL EARLY WARNING NETWORKS IN EUROPE"

- [Call](#): "Environment";
- [Partners \(10\)](#): CIEMAT (Spain); CMI (Czech Republic); ENEA-INMRI (Italy); **IFIN-HH (Romania)**; LNE-LNHB (France); MIRS/IJS/F-2,O-2 (Slovenia); NPL (United Kingdom); PTB (Germany); SCK-CEN/LNK (Belgium); TAEK (Turkey);
- [Project responsible](#): Dr. Sorin BERCEA (bercea@nipne.ro);
- [Duration](#): 2014-2017;
- [Scope](#): Metrology support for radiological early warning networks in Europe;
  
- [Results](#):
  - the development and validation of novel and improved dosimetry systems for field station use for the measurement of dose;
  - the development and validation of improved detection methods for the measurements of low activity concentrations of radon;
  - the development and validation of novel and improved mobile instrumentation for the field monitoring ;
  - the development of a new and more sophisticated data analysis protocols to enable rapid information dissemination;

# METROABSORB: "ABSORBED DOSE IN WATER AND AIR"

- [Call](#): "Research Potential";
- [Partners \(10\)](#): BEV (Austria); CMI (Czech Republic); GUM (Poland); HMI/IRB-SSDL (Croatia); **IFIN-HH (Romania)**; IMBiH (Bosnia and Herzegovina); IST/LPSR (Portugal); LNE-LNHB (France); SCK-CEN/LNK (Belgium); VINS (Serbia);
- [Project responsible](#): Dr. Sorin BERCEA (bercea@nipne.ro);
- [Duration](#): 2015-2017;
- [Scope](#): Metrology support for absorbed dose in water and air measurements;
- [Results](#):
  - the study of the design of water calorimeter primary standards so that participating NMIs and DIs seeking to establish a research capability in measuring adsorbed dose to water for high energy beams;
  - the establishment of a research capability in measuring the air kerma for low or medium X-ray energies used in radiation protection and diagnostic;
  - the study of the design of cavity chamber primary standards to establish a research capability in measuring the air kerma for photon energies such as those of Co-60 and Cs-137 used in radiotherapy;

# METRORADON: "METROLOGY FOR RADON MONITORING"

- [Call](#): "Environment";
- [Partners \(9\)](#): BEV (Austria); BFKH (Hungary); CMI (Czech Republic); **IFIN-HH (Romania)**; LNE-LNHB (France); METAS (Switzerland); PTB (Germany); STUK (Finland); VINS (Serbia);
- [Project responsible](#): Dr. Aurelian LUCA (aluca@nipne.ro);
- [Duration](#): 2017-2020;
- [Scope](#): Metrology support to radon monitoring;
  
- [Goals](#):
  - to develop novel procedures for the traceable calibration of radon (Rn-222) measurement instruments at low activity concentrations (100 Bq/m<sup>3</sup> to 300 Bq/m<sup>3</sup>) with relative uncertainties  $\leq 5\%$ ;
  - to investigate and to reduce the influence of thoron (Rn-220) and its progeny on radon end-user measurements;
  - to validate traceability of European radon calibration facilities, and to publish guidelines and recommendations on calibration and measurement procedures for the determination of radon concentration in air;

# IFIN-HH VERY NEXT FUTURE COLLABORATIONS ...



- [Submitted project proposal](#): MetroHiLET
- [Call](#): "Health";
- [Duration](#): 2019-2022;
- [Partners \(11\)](#): NPL (UK); PTB (Germany); CEA (France); CIEMAT (Spain); **IFIN-HH (Romania)**; SCK (Belgium); INSERM (France); UKW (Germany); AUSL (IT); Oxford Univ. (UK); RSCH (UK); ANU (Australia);
- [Project responsible](#): Dr. Mihail-Razvan IOAN (razvan.ioan@nipne.ro);
- [Scope](#): Metrology support for emerging radiopharmaceuticals delivering high linear energy transfer radiation;
- [Goals](#):
  - to develop traceable radioactivity measurements with reduced uncertainties and to improve the nuclear data for a range of medical alpha and Auger emitting radionuclides;
  - to enable accurate dosimetry calculations for emerging alpha and Auger radiopharmaceuticals;
  - to develop a public database, that provides a universal tool for the benchmarking and harmonisation of radionuclide image quantification and dosimetry software in multi-centre studies;

!!! THANK YOU FOR YOUR ATTENTION !!!