

## **Title: Ionising radiation metrology for homeland security**

### **Abstract**

This JRP addresses the need for reliable and comparable measurement results to reveal illicit trafficking of explosives and nuclear material and to detect radiation dispersion devices or improvised nuclear devices. Present techniques are unable to prevent with sufficient security such serious threats to EU citizens, trade and economy. Novel and emerging technologies, as well as standards and reference materials, based on ionising radiation need to be developed to achieve the maximum performance (contraband detection rates) at minimum false alarm with the lowest possible radiation doses to protect inspected freight, environment and staff, whilst ensuring the traceability and accuracy of such measurements.

### **Conformity with the Work Programme**

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Health, New Technologies & Fundamental Metrology on pages 9, 10, 18 and 25

### **Keywords**

Neutron and Gamma Radiation; Radiation Imaging and Spectroscopy; Cargo Inspection; Mass Spectrometry; Forensics

### **Background to the Metrological Challenges**

Security-related metrology is capable of providing growing public security need and is central to the development of instrumentation at the technological frontiers for such needs and includes a variety of invasive and non-destructive techniques. Key issues in ionising radiation metrology for security are:

- Imaging and inspection for vast quantities of goods moved both within the EU and other markets. Rapid, accurate and traceable systems and techniques with low failure rates are essential;
- Pre- and post-detonation analysis of illicit nuclear material and post detonation consequence management. To successfully (i) attribute source material, leading to identification of component materials and event perpetrators, and (ii) carry out consequence management in post-detonation situations.
- Testing of security oriented ionising radiation measurement devices.

In order to effectively deal with these issues:

- Investigation into traceable accelerated non-destructive imaging and inspection techniques is required to allow rapid throughput while delivering confidence in monitoring results.
- Suitable certified reference materials (CRMs) are needed to support pre- and post-detonation analysis of illicit nuclear material in three areas: (i) high purity standards of radioactivity, (ii) matrix reference materials, and (iii) radiochemical yield tracers for bioassay.
- Testing regimes of measurement devices

### **Scientific and Technological 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 JRP-Protocol.

The JRP shall focus on the deployment of novel and emerging technologies for cargo inspection with ionising radiation and the detection and identification of illicit nuclear materials. The aim is to achieve the maximum performance of existing and emerging techniques at a minimum false alarm with the lowest possible radiation doses to protect inspected freight and environment, whilst ensuring the traceability and accuracy of such measurements.

The specific objectives are:

1. Characterisation of state-of-the-art and novel radiation sources for continuous and pulsed X-ray, gamma ray and neutron radiation.
2. Traceable characterisation of spectrometers and imaging systems.
3. Development of rapid traceable imaging and inspection techniques of bulk items that allow rapid throughput, without loss of accuracy.
4. Development and test of certified reference materials (CRMs) that address any gaps in the needs for identification and attribution of illicit nuclear material for both radiation dispersal devices (RDDs) and improvised nuclear devices (INDs) in both pre-detonation and post-detonation scenarios.

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the research, the involvement of the appropriate user community such as industry, and standardisation and regulatory bodies, is strongly recommended.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

The total eligible cost of any proposal received for this SRT is expected to be around the 2.7 M€ guideline for proposals in this call.

## Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (eg letters of support) is encouraged.

You should detail other impacts of your proposed JRP as detailed in the document “Guide 4: Writing a Joint Research Project”

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies
- transfer knowledge to the national governments within the EU; border control agencies; anti-terrorism agencies; homeland security agencies; research institutes developing related technologies and instrumentation and manufacturers

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology. 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 Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

## Time-scale

The project should be of up to 3 years duration.