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Acceptance of the proposal for a new international standard for list-mode data used in nuclear instrumentation

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Abstract

This report is the Deliverable D1 of the EMPIR project 14SIP07 "DigitalStandard", which corresponds to Deliverable 1 of the JRC work package 3883 "DisNU".

The use of digital data acquisition for the detection and measurement of radioactivity is increasing over the years since it offers advantages over data acquisition with conventional modular systems. Modern digital systems sample the signal directly from the radiation detector at a high rate and present data in a digital manner to computer systems for further processing and analysis. However, there is currently no standard for the format of the data presented by such systems. The lack of a standardised data format hinders the interoperability between hardware for data acquisition and software for data analysis.

The need for such a standard has been identified earlier by the FP7 EMRP MetroFission project and confirmed by CEN/TC 391 in the frame of Commission mandate M/487 to the European Standardisation Organisations. Within the Horizon2020 EMPIR DigitalStandard project, a consortium of four EU Member States, under the lead of the JRC, developed a preliminary draft international standard and submitted it together with a New Work Item Proposal to the IEC/TC 45 "Nuclear Instrumentation".

The proposal to develop the standard has been accepted, a project team has been appointed by the TC 45 National Committees and a liaison category A has been established between JRC and IEC/TC 45. The liaison officer will lead the project to develop the new standard. Forecast publication date of the standard is March 2019. The first Committee Draft should be finalised for circulation to the IEC/TC 45 National Committees by October 2016.

1 Introduction

Digital data acquisition instruments used for the detection and measurement of ionising radiation are becoming more and more popular since they offer advantages over data acquisition with conventional modular systems. Modern digital systems sample the signal directly from the radiation detector at a high rate and present data in a digital manner to computer systems for further processing and analysis. However, there is currently no standard for the format of the data presented by such systems, which hinders the interoperability between hardware for data acquisition and software for data analysis. The need for a standard was recognised by CEN/TC 391 "Societal and Citizen Security" in the frame of mandate M/487, and earlier by the European Metrology Research Programme "MetroFission"^[1].

In response to Commission Mandate M/487 "Security standards" to the European Standardisation Organisations^[2], CEN/TC 391 prioritised over 300 standardisation proposals from more than 200 experts in the sectors CBRNE, border security and crisis management/civil protection. The standardisation of the list-mode data was assigned, together with three other proposals, the highest priority as documented in the M/487 Phase 2 report ^[3] developed by CEN/TC 391.

The Commission responded to the CEN M/487 Phase 2 report by defining new priorities and standardisation activities, by means of:

- A new request to CEN proposing 9 European Standards related to Crisis Management and CBRNE;
- An administrative arrangement under Horizon2020 with the European Reference Network for Critical Infrastructure Protection (ERNICIP), coordinated by JRC. The administrative arrangement addresses four threats in the CBRNE area, including RN threats to critical infrastructure.

ERNICIP's mission is to foster the emergence of innovative, qualified, efficient and competitive security solutions, through the networking of European experimental capabilities^[4]. The networks are centralised around different Thematic Groups. The Thematic Group on Radiological and Nuclear threats to critical infrastructure performed the pre-normative research for the standardisation of the list-mode data format.

One of the objectives of the ERNICIP Thematic Group on Radiological and Nuclear threats to critical infrastructure was to develop a report/draft standard to include the basic elements concerning the format of list-mode data generated by digital nuclear electronics, for consideration by the appropriate standardisation committee.

In this respect, in 2014 the Thematic Group published the following reports:

- State-of-the-art report on list-mode data acquisition based on digital electronics^[5], which includes the basic elements of the proposed standard;
- Report on critical parameters and performance tests for the evaluation of digital data acquisition hardware^[6].

In 2015, an online survey was conducted to assess the needs of the end-users of digital data acquisition systems. The results of the survey^[7] were taken into account in the development of a preliminary draft international standard by the EMPIR DigitalStandard consortium.

The ERNICIP Thematic Group on Radiological and Nuclear Threats to Critical Infrastructure triggered the establishment of a consortium of four European Union Member States which receive funding from the Horizon2020 European Metrology Programme for Innovation and Research. Funded consortium partners are NPL (United Kingdom – lead partner), STUK (Finland), CEA (France) and ENEA (Italy). The JRC takes

part in the consortium as an unfunded partner and leads the task of development of the standard.

The DigitalStandard project is a Support for Impact Project (14SIP07) following up on the EMRP project MetroFission. The project is included in the JRC's work programme under work package 3883 "DiSNU". The DigitalStandard consortium has the objectives to develop an accepted committee draft international standard, and to develop software to support the implementation of the standard.

This document reports on the submission, by the DigitalStandard consortium, of a New Work Item Proposal for the development of a new international standard to the International Electrotechnical Commission (IEC), and the acceptance of this proposal.

2 A new work item proposal to IEC

On 15/10/2015, the JRC submitted a New Work Item Proposal^[8] to the IEC, Technical Committee 45 "Nuclear Instrumentation", in agreement with the DigitalStandard consortium. The proposal was accompanied by a preliminary draft standard, developed by the consortium. The scope of IEC/TC 45 is to prepare international standards relating to electrical and electronic equipment and systems for instrumentation specific to nuclear applications¹.

The New Work Item Proposal was circulated for vote to the IEC/TC 45 National Committees on 30/10/2015. In TC 45, 19 National Committees have voting rights. In order to be accepted, a simple majority has to approve the proposal and at least 5 members shall appoint experts that contribute to the development of the standard.

After the three month voting period, on 12/02/2016 the voting results were published^[9]. 13 National Committees expressed their vote; all of them voted for acceptance; 12 experts were appointed, of which 2 are participating in the EMPIR DigitalStandard project.

The work was assigned to IEC/TC 45/WG 9 "Detectors and systems". The project was assigned the number IEC 63047. This number will become the identification of the published standard. The liaison category A, requested by JRC, was approved at the plenary meeting of TC 45 in Korea on 12/03/2016. The JRC liaison officer (also participating in the DigitalStandard project) will lead the development of the IEC standard.

During the three month voting period, the National Committees have the opportunity to comment on the preliminary draft accompanying the New Work Item Proposal. At the WG 9 meeting on 09/03/2016, the comments were discussed and solutions were agreed upon.

It is noted that the copyrights for all drafts and International Standards and other IEC publications belong to IEC. For that reason, the preliminary draft standard, the New Work Item Proposal^[8] and the voting results^[9] cannot be included in this report. The status of the development of IEC 63047 is shown on the website of IEC/TC 45: <http://www.iec.ch/tc45>, tab "Projects/Publications".

¹ The international standards organisations ISO, IEC and ITU act at the global level. The standards they develop can be adopted at the European level by the European Standardisation Organisations CEN, CENELEC and ETSI, respectively. In the scope of nuclear instrumentation, CENELEC does not develop standards. The respective committee CENELEC/TC 45B may adopt the standards developed by IEC/TC 45 and SC 45B as European Standards.

3 Further steps

Essential to a successful acceptance of a standard is the involvement of the key stakeholders and the validation of the standard at an early stage during its development. The primary users of the standard are manufacturers of instruments for digital data acquisition. Through a publication of a call for expression of interest^[10] in the Official Journal of the European Union, JRC invites manufacturers to comment on the draft standard and/or to test high-performance instruments at the EUFRAT^[11] nuclear facilities of JRC-IRMM.

Manufacturers who express their interest will be invited to participate to an IEC 63047 workshop organised at JRC-IRMM on 15-17/06/2016. They will have the opportunity to discuss the standard and acquire the insight needed to implement the draft standard in their hardware or software. The EMPIR DigitalStandard consortium partners and the experts appointed by IEC/TC 45 are also invited, to discuss the standard with the manufacturers, with the aim of reaching consensus on the first Committee Draft to be prepared.

Secondary users of the standard are scientists, engineers and developers of software for data analysis. A guidance report will be developed that explains the implementation of the standard using ASN.1 tools that are available on the market as commercial or open source software.

The development of an international standard follows different stages in a strict schedule^[12]. The next stage is the preparatory stage, in which a first Committee Draft is prepared for circulation to the IEC/TC 45 National Committees by October 2016.

The forecast publication date of the standard is March 2019.

4 Conclusion

The IEC recently approved the proposal to develop an international standard for the data format for digital instrumentation used for the detection and measurement of ionising radiation. The proposal was submitted by JRC and the consortium partners in the frame of the EMPIR DigitalStandard project.

The standard will be developed by the EMPIR DigitalStandard consortium partners and the appointed experts by IEC/TC 45, with the input from equipment manufacturers, who are the primary stakeholders.

This standard is developed at the international (global) level and will ensure interoperability between data acquisition hardware and software for data analysis.

By the publication of a guidance document, equipment manufacturers, scientists and software developers will be assisted on how to use the standard most effectively.

A first Committee Draft will be prepared for circulation to the IEC/TC 45 member countries by October 2016.

The forecast publication date of the standard is March 2019.

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- [12] IEC website, page explaining the development process of an international standard; <http://www.iec.ch/standardsdev/how/processes/development/>

List of abbreviations

CBRNE	Chemical, Biological, Radioactive, Nuclear, Explosives
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
EMPIR	European Metrology Programme for Innovation and Research
EMRP	European Metrology Research Programme
ERNICIP	European Reference Network for Critical Infrastructure Protection
ETSI	European Telecommunications Standards Institute
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITU	International Telecommunication Union
M/487	Commission Mandate 487 to the European Standardisation Organisations
SC	Subcommittee, within a standards organisation
TC	Technical Committee, within a standards organisation

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Stimulating innovation
Supporting legislation*

