HORIZON 2020

RESEARCH INFRASTRUCTURES

H2020-INFRAIA-2014-2015

INFRAIA-1-2014-2015 INTEGRATING AND OPENING EXISTING NATIONAL AND REGIONAL RESEARCH INFRASTRUCTURES OF EUROPEAN INTEREST

ENSAR2

EUROPEAN NUCLEAR SCIENCE AND APPLICATION RESEARCH 2

GRANT AGREEMENT NUMBER: 654002

D8.8 – NUPIA – REPORT ON COURSES IN NUCLEAR TECHNIQUES FOR INDUSTRIAL PARTNERS

Version: 1.0
Author: Paul Greenlees
Date: 28/02/2020

PROJECT AND DELIVERABLE INFORMATION SHEET

ENSAR2 Project Ref. №	654002
Project Title	European Nuclear Science and Application Research 2
Project Web Site	http://www.ensarfp7.eu/
Deliverable ID	D8.8
Deliverable Nature	Report
Deliverable Level*	PU
Contractual Date of Delivery	February 29th 2020
Actual Date of Delivery	February 29th 2020
EC Project Officer	René Martins

* The dissemination level are indicated as follows: PU – Public, PP – Restricted to other participants (including the Commission Services), RE – Restricted to a group specified by the consortium (including the Commission Services). CO – Confidential, only for members of the consortium (including the Commission Services).

DOCUMENT CONTROL SHEET

Document	Title:	
	ID:	
	Version	
	Available at: http://www.ensarfp7.eu/	
	Software Tool: Microsoft Office Word 2007	
	File:	
Authorship	Written by:	Paul Greenlees, JYU
	Contributors:	
	Reviewed by:	A. Jokinen, JYU
	Approved by:	M.N. Harakeh, KVI Cart

DOCUMENT STATUS SHEET

Version	Date	Status	Comments
0.1	11/02/2020	For internal review	
1.0	28/02/2020	For internal review	
1.0	29/02/2020	Submitted on EC Participant Portal	
		Final version	

Document Keywords

Keywords	Nuclear Physics InnovAtion, survey of courses

Disclaimer

Copyright notices

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This document presents the final report of Task 3 of the NuPIA (Nuclear Physics InnovAtion) Network Activity of ENSAR2 (WP8).

INTRODUCTION

As part of the NuPIA activities, a survey of courses available at all beneficiary and partner institutes was carried out. From amongst the ENSAR2 beneficiaries and partners, 14 responded to the survey. From these, six institutions reported they either currently offered courses open to industry or would be prepared to do so. Often these courses formed either part of a broader offering at MSc level, with participants from industry studying for an MSc degree whilst working (for example, from the Nuclear Energy industry). The results of this survey were reported in deliverable D8.6. On the basis of the survey, two institutions, the University Of Liverpool (ULIV) and the University Of Jyväskylä (JYU) were identified as providing courses, which would be suitable to be offered to industrial partners. The main themes of the courses are in the basic principles of radiation detection and measurement, an understanding of which is essential in many fields of applied physics. Examples are the need to understand the interaction of radiation with matter, in order to develop methods and measurement techniques in radiation therapy, medical imaging, industrial measurement and in materials characterisation. The courses at ULIV form part of the Radiometrics: Instrumentation and Modelling MSc course. At JYU, it was originally planned to allow participants from industry to join a large 10 ECTS course "Techniques for Nuclear and Accelerator-Based Physics Experiments", which includes a large number of lectures and intensive hands-on experimental work. However, it was found that in practice this approach would be unworkable and a decision was made to offer three, shorter courses specifically tailored to industry. The courses offered at ULIV and JYU are listed and discussed further below.

COURSES OFFERED AT ULIV

As described above, the courses offered at ULIV form part of a well-established programme of studies, which can lead to a MSc degree in Radiometrics. The courses offered from 2018-2020 with the total number of participants and number of participants from industry are outlined below. The subjects dealt with in the courses are well suited to the requirements of the Nuclear Energy and related industries, or for example, in Health Services (medical imaging, hospital physicist, etc.). As can be seen from the table, the courses offered are consistently attended by participants from industry. Some courses have been very well attended, with up to 50% of participants from industry.

COURSE CODE	**COURSE TITLE**	**DATES FOR 2018/2019/2020**	
PHYS810	Radiation Protection and Dosimetry (RPD)	1st week in October 18	10 participants, **2 from industry**
PHYS802	Principles of Radiation Detection (PRD)	3rd week in October 18	10 participants, **2 from industry**
PHYS804	High-Resolution Gamma Spectrometry (HRGS)	4th week in November 18	15 participants, **4 from industry**
PHYS820	Radiation Shielding (N11) - MCNP modelling	3rd week in January 19	35 participants, **12 from industry**
PHYS809	Statistics, data collection and analysis (SDA)	1st week in February 19	20 participants, **2 from industry**
PHYS805	Gamma detection and modelling	3rd week in February 19	18 participants, **1 from industry**

PHYS807	Neutrons: Detection and Modelling (NDM)	1st week March 19	10 participants, **2 from industry**
PHYS812	Environmental Aspects	3rd week in March 19	10 participants, **2 from industry**
PHYS808	Nuclear Instrumentation (NIS)	1st week in April 19	15 participants, **2 from industry**
PHYS810	Radiation Protection and Dosimetry (RPD)	1st week in October 19	12 participants, **2 from industry**
PHYS802	Principles of Radiation Detection (PRD)	3rd week in October 19	12 participants, **2 from industry**
PHYS804	High-Resolution Gamma Spectrometry (HRGS)	4th week in November 19	15 participants, **6 from industry**
PHYS820	Radiation Shielding (N11) - MCNP modelling	3rd week in January 20	30 participants, **15 from industry**
PHYS809	Statistics, data collection and analysis (SDA)	1st week in February 20	20 participants, **1 from industry**
PHYS805	Gamma detection and modelling	3rd week in February 20	10 participants, **3 from industry TBC**
PHYS807	Neutrons: Detection and Modelling (NDM)	1st week March 20	12 participants, **5 from Industry TBC**
PHYS812	Environmental Aspects	3rd week in March 20	10 participants, **2 from industry TBC**
PHYS808	Nuclear Instrumentation (NIS)	1st week in April 20	15 participants, **2 from industry TBC**

COURSES OFFERED AT JYU

After some deliberation, a decision was taken at JYU to offer three courses directly tailored to enable participation of staff from industrial partners. These three courses were based on the lectures and hands-on practical work which forms part of a 10 ECTS course "Techniques for Nuclear and Accelerator-Based Physics Experiments". In their usual form, the lectures and practical work are at a very high level and require considerable pre-requisite knowledge. Along with other administrative and logistical issues, this mismatch with the requirements of local students and possible participants from industry led to the suggestion of the following three courses, each of which would have been carried out over a period of two days:

Materials Characterisation with Ion Beams

3–4 December 2020

Content:

- Introduction to ion-matter interactions
- Ion-beam-analysis techniques
    - Rutherford Backscattering Spectrometry (RBS)
    - Nuclear-Reaction Analysis (NRA)
    - Elastic-Recoil Detection Analysis (ERDA)
- Lectures 6 hrs
- Hands-on exercises with 1.7 MV Pelletron Accelerator
- RBS and ERDA (3 hours measurements + 2 hours analysis)

Effects of Radiation on Electronics Components

10–11 December 2020
Content:

- Radiation Environments (from space to ground)
- Basic mechanisms of radiation effects in components and systems
- Principles of radiation effects testing

- Lectures (8 hrs)
- Hands-on exercises with electronic components (3 hrs)

Interaction of Radiation with Matter and Radiation Detection Techniques
17–18 December 2020
Content:

- Interaction of radiation with matter, principles of radiation detection, introduction to radiation detectors and basic signal processing

- Lectures (6 hrs)
- Hands-on exercises with various radiation detectors (6 hrs)

The first course could potentially be of interest to a wide range of industries, for example, the semiconductor industry or those working with development of materials and surface processing such as atomic layer deposition. The second course is of potential interest to partners from aerospace industries (space and satellite companies). Also, since the scale of electronic circuits is now in the nanometre range, these electronic components are becoming sensitive to radiation effects at ground level, thus a wider range of industries are becoming interested in the consequences of radiation for the stability and longevity of electronic devices. The final course is more similar in nature to those offered at ULIV, with potential interest from the Nuclear Energy industries, but also those employing radiation detection techniques for many measurement purposes (for example, in Finland these are widely used in the paper industry).
The course offerings were advertised at the NuPIA brokerage events, and through the mailing lists and networks of ENSAR2 and the JYU users, but unfortunately the courses did not attract sufficient interest from industrial partners and the courses were not held as planned within the ENSAR2 period.

CONCLUSION

The partners and beneficiaries of ENSAR2 have considerable expertise and know-how in a wide range of experimental techniques and particularly in the use of radiation, radiation detection and radiation protection, which could potentially be of interest and utilised in training of staff from industry. The courses held at ULIV have demonstrated successfully that participation of industrial partners alongside traditional students is possible (at least at the MSc level). Though the trial at JYU was not possible to carry out within the ENSAR2 period, some lessons can be learned from this: the content and period (time away from normal work) should be tailored specifically for the target industries and participants. In this respect, the links to and dialogue with industrial partners of the ENSAR2 participants should be improved in order to better understand the requirements of industry and to better develop and market the potential courses, which could be offered.